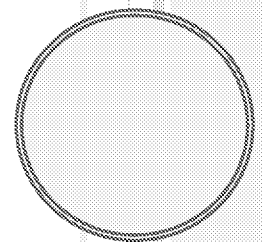


Groundwater Collaboration Workgroup

Final Report

June 2016



Contents

List of Recommendations.....	2
<i>Short-term Solutions Workgroup</i>	<i>3</i>
<i>Compliance Workgroup.....</i>	<i>5</i>
<i>Best Management Practices/Sensitive Areas Workgroup.....</i>	<i>6</i>
<i>Communications Workgroup</i>	<i>7</i>
Introduction.....	10
<i>Groundwater Issues in Kewaunee County.....</i>	<i>11</i>
<i>Local Action.....</i>	<i>12</i>
Chapter 1 – Short-term Solutions Workgroup Recommendations	14
Chapter 2 – Compliance Workgroup Recommendations	17
Chapter 3 – Best Management Practices/Sensitive Areas Workgroup Recommendations	21
Chapter 4 – Communication Workgroup Recommendations	25
Appendix A – Workgroup Structure	29
Appendix B – Short-term Solutions Workgroup	30
Appendix C – Compliance Workgroup.....	32
Appendix D – Best Management Practices/Sensitive Areas Workgroup.....	37
Appendix E – Communications Workgroup	61
Appendix F – Related Studies and Reports.....	62

List of Recommendations

The following recommendations are organized under the specific workgroup responsible for each set of recommendations.

The recommendations below received general consensus from workgroups. Other ideas or proposals put forth by the workgroups that received discussion but did not receive consensus, or were brought forward but were not discussed, are located in the appendices of this report (starting on [page 29](#)).

The recommendations are provided by multiple stakeholders and are not endorsed by any particular agency or group. To view how these recommendations were prioritized by each workgroup, along with additional information, please see the specific chapters dedicated to each workgroup in this report.

Also, recommendations from some workgroups are organized based on the organizations responsible for implementing those recommendations. Definitions for entities references in the report include (in alphabetical order):

Agriculture – Practice of farming which typically includes the rearing of animals to provide food and other products and the cultivation of the soil for growing of crops.

CAFO – Concentrated Animal Feeding Operation, which are animal feeding operations housing 1,000 animal units or greater.

Complainant – An individual or group that has reported concerns regarding potential violations typically to a government agency.

County/Kewaunee County – County government, including Kewaunee County Land and Water Conservation Department (LWCD), County Health Department, County Zoning, etc.

County LCWD – County department responsible for oversight of agricultural facilities and practices affecting soil and water quality.

Crop Consultant or Agronomist – Individuals/companies providing services to the agriculture industry primarily regarding cropland and nutrient management.

DATCP – Wisconsin Department of Agriculture, Trade and Consumer Protection (state government agency)

DHS – Wisconsin Department of Health Services (state agency)

DNR – Wisconsin Department of Natural Resources (state agency)

EPA – U.S. Environmental Protection Agency (federal agency)

Farmer – Owners and managers of CAFO and non-CAFO operations

Hauler – Individuals/companies who haul and land apply farm generated manure and process wastewater to cropland from farming operations.

Industrial – Individuals/companies who haul industrial generated waste to cropland from industrial operations such as cheese manufacturing plant.

Legislative – State and local legislators, including representatives and senators.

Local Groups – Organizations involved in environmental/agricultural protection efforts.

NRCS – Natural Resources Conservation Service (federal agency)

Septage – Individuals/companies who haul domestic generated septage waste to cropland or to municipal treatment plant (typically from private home septic systems and holding tanks).

Short-term Solutions Workgroup

- Consider increasing funding to the state Well Compensation program if changes in policy or statute cause a funding deficit. **(Legislative)**
- State legislators appropriate for \$300,000 in, onetime, special funds to provide reparations, including, providing emergency safe water supplies, treatment systems, and new well construction, to households with wells impacted by offsite livestock contamination. **(Legislative)**
- Consider taking action to make revisions to Wisconsin State Statute 281 which includes the provision for the Well Compensation program. **(Legislative)**
- Specific revisions to include:
 - Raising or removing income limitations
 - Clarify potential payment procedures
 - Raise or eliminate any total payment limitations.
 - Alter specific sampling requirements to foster a more efficient process for well owners that may be in a pre-determined Area of Special Well Compensation Eligibility.
 - Include other agricultural contaminants as eligible indicators of livestock contamination. (i.e. nitrate, viruses, and other detectable pathogens)
 - Add specific language that allows for the creation of large Areas of Special Well Eligibility for Well Compensation tied to vulnerability geology and livestock contamination.
- DNR consider beginning an investigation on all E.coli positive samples reported to them from well owners in Kewaunee County. If offsite livestock contamination seems plausible investigation will include Microbial Source Tracking (MST) sampling at no cost to the well owner. **(DNR)**
- Consider increase funding for follow-up sampling and investigation in relation to E coli positive samples in which offsite livestock contamination is the probable cause. **(DNR)**
- DNR create a brochure/fact sheet detailing bacteria contamination with information on potential sources, contamination definition, remediation, and funding assistance. This document should be shared with all stakeholders including laboratories in Wisconsin certified for bacteria analysis. **(DNR)**

- Develop a communication plan for distributing to the public the recommendations discussed and findings of the Short Term Solutions workgroup. This may include consideration of coordinating and holding a public meeting or series of meetings and participation by all workgroup members. **(DNR)**
- If E. coli contamination is detected and evidence suggests livestock contamination or a contamination event occurs, letters are sent to nearby households that are determined to be potentially impacted. **(DNR)**
- Develop clear guidance at the county and DNR level regarding respective processes for responding to a contamination event. **(DNR)**
- Prioritize investigating the possibility of streamlining the creation of Special Areas of Eligibility for Well Compensation in Kewaunee County based on the potential for groundwater contamination by livestock due to vulnerable geologies and common land use practices. **(DNR)**
- Use its authority under Chapter NR738 of Wisconsin Administrative code to provide emergency water supplies to well owners whose wells are impacted by offsite livestock bacterial or nitrate contamination that are located within an area of Special Eligibility for Well Compensation. **(DNR)**
 - If DNR does not allow for nitrate contamination to trigger compensation in Areas of Special Eligibility for Well Compensation then it should consider modifying the definition of hazardous substance in NR738 to include nitrate contamination from livestock.
- Develop a protocol to immediately provide an emergency supply of drinking water for owners of wells impacted by offsite contamination until another source of safe drinking water can be provided or a long term solution is in place. **(County)**
- Consider annually making \$10,000 and staff available to provide emergency water supplies free of charge to those households with wells impacted by offsite livestock contamination. **(County)**
- County actively seek and obtain grants and other programs whose funds would be appropriated to paying for a semi-annual well testing program, emergency water supplies, and potential remediation of contaminated wells. **(County)**
- The Kewaunee County Health Department work with DNR to create and distribute a letter to all county well owners detailing the importance of private well sampling. This letter should include information about obtaining sample kits, contaminants to sample for, follow up to results, and specific contact information for DNR and Kewaunee Co. **(County)**
- Provide informational materials to county well owners that include easy to use contact information lists (i.e. refrigerator magnets) and up to date well safety and maintenance checklists. **(County)**
- Develop clear guidance at the county and DNR level regarding respective processes for responding to a contamination event. **(County)**

- Community groups are working with local municipal drinking water systems to set up a method for owners of wells impacted by livestock contamination to attain a safe emergency water supply from them as a temporary solution until other recommendations are implemented. **(Local groups)**
- Agricultural producers consider making emergency water supplies available for owners of wells impacted by livestock contamination. **(Local groups)**
- Area farmers or other local citizen groups consider forming a group to create a fund to provide emergency water supplies free of charge to those households with wells impacted by offsite contamination. **(Local groups)**
- Local Non-Profit groups consider contacting United States of Agricultural (USDA) in regards to the USDA “Household Water Well System” Grants. **(Local groups)**

Compliance Workgroup

- Conduct more land application hauling audits/oversight in sensitive areas. **(DNR and County)**
- Staffing - Add compliance staff position(s) (DNR Agricultural Runoff/Nonpoint Specialists) to conduct improved compliance oversight (examples listed below) of existing regulations regarding agriculture in sensitive areas. Fill vacancies in a timelier manner. **(DNR)**
- More stringent review of CAFO emergency land spreading variances. **(DNR)**
- Require that all land applicators have, at minimum, one set of spreading restriction maps and written instructions present for land application sites where manure is actively being applied. **(DNR & County)**
- Targeted focus on proper well abandonment of non-compliant wells or wells no longer used. **(DNR)**
- Further evaluation and review of existing enforcement processes. **(DNR, County, EPA)**
- Fill currently vacant DNR conservation warden position in Kewaunee County. **(DNR)**
- Continue and improve communications and outreach to farmers/landowners from agencies (DATCP, NRCS, County LWCD) regarding:
 - Winter (frozen or snow-covered ground) spreading
 - General cropland best management practices
- Develop guidance that defines and explains “substantial compliance” requirement for CAFO permit reissuance. May include: inspection checklist updates; staff training, template reporting resources, and clearer permit conditions. **(DNR, EPA)**
- Resources/Technology for agricultural compliance staff use and efficiency (internal/non-public) – database of information electronically accessible for multiple compliance agencies. **(EPA, DNR, County)**

- During land application complaint response, DNR and County shall encourage having all associated parties present during complaint inspection. **(Farmer, hauler, crop consultant, complainant)**
- Develop communication plan for all landowners who rent land for application of wastes. **(County/Local groups)**
- Improve review and approval process of offsite waste distribution by non-agricultural waste generators into agricultural waste storages. **(DNR & County LWCD)**
- Develop communication plan for public regarding compliance and enforcement activities being conducted by DNR. **(Agricultural, industrial and septage)**

Best Management Practices/Sensitive Areas Workgroup

[NOTE: The following recommendations are not listed by the entity/organization responsible. Members of the Best Management Practices/Sensitive Areas Workgroup agreed that these recommendations are interim steps that farmers can implement on a voluntary basis to reduce the risk for groundwater contamination. Workgroup members agreed to revisit these recommendations in the following year to gauge effectiveness and discuss other proposals.]

- No mechanical applications of manure on soils with a soil depth less than 12 inches to bedrock.
- Inspect fields according to a., b., and c. below for depth to bedrock, groundwater conduits, contributing channels or areas that drain to groundwater conduits, drain tiles that may drain/discharge to groundwater conduits and evidence of fracture traces; keep inspection logs and update NMP maps with identified features.
 - a. Inspect annual cropped fields in spring before manure application, tillage, or planting or in late summer/fall after crop harvest and before manure application, tillage, or planting.
 - b. Inspect alfalfa and perennial cropped fields in spring and summer before or 7-10 days after cutting – look for uneven crop growth that follows distinct lines.
 - c. Use direct measurements (backhoe, probe, test pits, etc.) to verify depth to bedrock and groundwater.
- On soils with less than 24" to bedrock, no manure applications of liquid manure are allowed. Liquid manure is defined as having less than 12% solids content.
- Depth to Bedrock Recommendations (Please see Appendix D, [page 37](#)).
- Direct Conduits to Groundwater Recommendations (Please see Appendix D, [page 37](#)).
- All nutrient sources and not just manure should be considered.
- All livestock operations that apply manure prepare and implement a NM plan that reflects, at a minimum, the proposed 2015 NRCS 590 standard.

- Analyze low solids content manure for ammonia and adjust the first year available nitrogen based on the results, per UW A2809, Nutrient Application Guidelines, Chapter 9, page 73, Table 9.1
<http://corn.agronomy.wisc.edu/Management/pdfs/A2809.pdf>
- Depressional groundwater recharge areas over shallow bedrock needs a clear definition; specifically the workgroup needs to define the term ‘shallow’
- Practices need to reflect manure type and not farm size. Manure characteristics (e.g., solids, nutrient and pathogen content) help better define groundwater contamination risk(s) and should be a primary criterion for practice recommendations.
- On soils with less than 12” to bedrock, livestock may be pastured as long as the following items are met:
 - a. Pasture is maintained in adequate, perennial vegetation;
 - b. Vegetation is maintained year round;
 - c. Producer develops and maintains a grazing plan; and
 - d. The grazing plan, at a minimum, meets both NRCS Standard 590, Nutrient Management and 528, Prescribed Grazing
<https://efotg.sc.egov.usda.gov/references/public/WI/528.pdf>
- The workgroup needs to focus on winter spreading plan requirements to address manure applications on soils > 20 feet to rock during winter – frozen or snow covered soils.
- For manure mixed with industrial waste, require chloride sampling and other applicable WPDES permit sampling requirements, as authorized under NR 214.17, Wis. Adm. Code, in addition to N, P, K.
http://docs.legis.wisconsin.gov/code/admin_code/nr/200/214.pdf

Communications Workgroup

[NOTE: Most of the recommendations listed below were also listed as part of the other workgroups’ recommendations.]

- To communicate/reach out to key stakeholders, audiences, etc. about the proposed recommendations of the workgroup. **(DNR, County, Local Groups)**
- To increase public’s awareness and understanding of the workgroup and the proposed recommendations as they affect the various stakeholders through potential legislative, administrative and/or voluntary changes (DNR, local governments, DATCP, etc.). **(DNR, County, Local Groups)**
- Provide the public and media better access to information about the workgroup’s process and the final report/proposed recommendations. **(DNR, County, Local Groups)**
- DNR create a brochure/fact sheet detailing bacteria contamination with information on potential sources, contamination definition, remediation, and funding assistance. This

document should be shared with all stakeholders including laboratories in Wisconsin certified for bacteria analysis. **(DNR)**

- If E. coli contamination is detected and evidence suggests livestock contamination or a contamination event occurs, send letters are sent to nearby households that are determined to be potentially impacted. **(DNR, DHS, DATCP)**
- Develop communication plan for public regarding compliance and enforcement activities being conducted by DNR (agricultural, industrial and septage). **(DNR)**
 - Discuss how to report/what to report (factsheets)
 - How to share complaint resolution / findings with public
 - Online accessible database
 - CAFO permits and application information
 - CAFO nutrient management plans
 - CAFO engineering information
 - Stepped enforcement actions
 - Enforcement letters (NON, NOV, etc.)
 - DOJ referral case summaries and outcomes once completed/settled
- The Kewaunee County Health Department work with DNR to create and distribute a letter to all county well owners detailing the importance of private well sampling. This letter should include information about obtaining sample kits, contaminants to sample for, follow up to results, and specific contact information for DNR and Kewaunee Co. (In progress)
(Kewaunee County)
- Provide informational materials to county well owners that include easy to use contact information lists (i.e. refrigerator magnets) and up to date well safety and maintenance checklists. **(Kewaunee County)**
- Develop clear guidance at the county and DNR level regarding respective processes for responding to a contamination event. **(Kewaunee County)**
- Develop a communication plan for distributing to the public the recommendations discussed and findings of the Short Term Solutions workgroup. This may include consideration of coordinating and holding a public meeting or series of meetings and participation by all workgroup members. **(DNR, County, Local Groups)**
- Inform haulers and farmers of requirement that all land applicators have, at minimum, one set of spreading restriction maps and written instructions present for land application sites where manure is actively being applied. **(DNR, County)**
- Develop clear guidance at the county and DNR level regarding respective processes for responding to a contamination event. **(DNR, County)**

- Continue and improve communications and outreach to farmers/landowners from agencies **(DATCP, NRCS, County LWCD)** regarding:
 - Winter (frozen or snow-covered ground) spreading
 - Explain why winter spreading is a concern.
 - Explain best management practices if winter spreading is necessary.
 - Provide resources for grant funding or technical assistance.
 - General cropland best management practices
 - Explain benefits of no till, cover crops, filter strips, etc.
 - Cost share funding
- During land application complaint response, DNR and County shall encourage having all associated parties present during complaint inspection (farmer, hauler, crop consultant, complainant) to promote understanding and communication. **(DNR, County)**
 - Copy all on follow-up letters and reports
 - Not required as not always practicable
- Develop communication plan for all landowners who rent land for application of wastes. **(County/Local groups)** The communication plan may include:
 - Information on regulations regarding land application of wastes
 - Example landowner agreements between farmers and landowners
 - Any potential liabilities of landowner
- Develop guidance and communication plans between DNR programs (wastewater and ag runoff) as well as between DNR, County and LWCD to improve review and approval process of offsite waste distribution by non-agricultural waste generators into agricultural waste storages. This will help ensure that any approvals for acceptance meet all standards/conditions and ensure storages proposed to accept offsite wastes are built to standards protective of groundwater. **(DNR & County LWCD)**

Introduction

Given the unique hydrogeology in certain regions of the state, specifically the karst geology in northeast Wisconsin, the Wisconsin Department of Natural Resources (DNR) and a number of local, state and federal partners convened a Groundwater Workgroup to assess issues regarding landspreading and contamination of groundwater and drinking water wells.

Specifically, the workgroup was established in response to concerns over contaminated drinking water wells in Kewaunee and Door counties, as well as a formal request from environmental groups and concerned citizens made to the U.S. Environmental Protection Agency (EPA), under the Safe Water Drinking Act, to investigate and address contaminated wells in Kewaunee County. The charge of the workgroup was to develop recommendations to reduce risk to groundwater quality and public health in Kewaunee County, with the idea that many of the recommendations could also be applied across Wisconsin.

The workgroup sought input from these and other stakeholders and partners to help shape recommendations and action plans. These stakeholders and partners include (but are not limited to) farmers, citizens, local officials, agricultural and environmental groups, DNR, EPA, county land and water conservation departments and other state/federal agencies.

The DNR served as facilitator for the issue workgroups. Four issue workgroups were created: Short Term Solutions; Compliance; Best Management Practices/Sensitive Areas and Communication.

Issues the workgroups focused on included (but were not limited to):

- identification of susceptible areas;
- landspreading/land application practices;
- drinking water wells and groundwater protection;
- nutrient management plans;
- funding and resources;
- compliance and enforcement activities/resources;
- spill response;
- local perspectives; and
- communications.

The workgroups began meeting in August, 2015 and completed their work in early 2016. The recommendations provided through the workgroup process are the focus of this report.

While some recommendations may be implemented by the DNR, many other recommendations may be proposed for CAFO operations, the dairy industry, local governments, other local agencies and state agencies (e.g. health departments), local organizations and the federal government.

NOTE: Individual stakeholder participation in this group does not equate to full implementation of any specific recommendation, or complete agreement by the entire stakeholder group.

June 2016

Groundwater Issues in Kewaunee County

Kewaunee County sits in the Lake Michigan basin and is primarily an agricultural county with approximately 173 farms. Of those farms, 16 are large Concentrated Animal Feeding Operations or CAFOs, which are defined as farms with greater than 1,000 animal units.

Since 1983, Kewaunee County has seen a cattle increase from 59,800 to approximately 98,000 total animals, with the number of dairy cows increasing from 30,300 to approximately 45,500 (WI Ag Statistics online). When cattle manure is land applied to cropland and pastures, it can be a source of nitrates and pathogens in groundwater.

One tool that manages farm nutrients is a Nutrient Management Plan. When implemented, these plans help to reduce the risk for groundwater contamination. Kewaunee County has been successful in implementing this best management practice, with approximately 80 percent of the cropland – 106,313 acres – under a certified 590 Nutrient Management Plan.

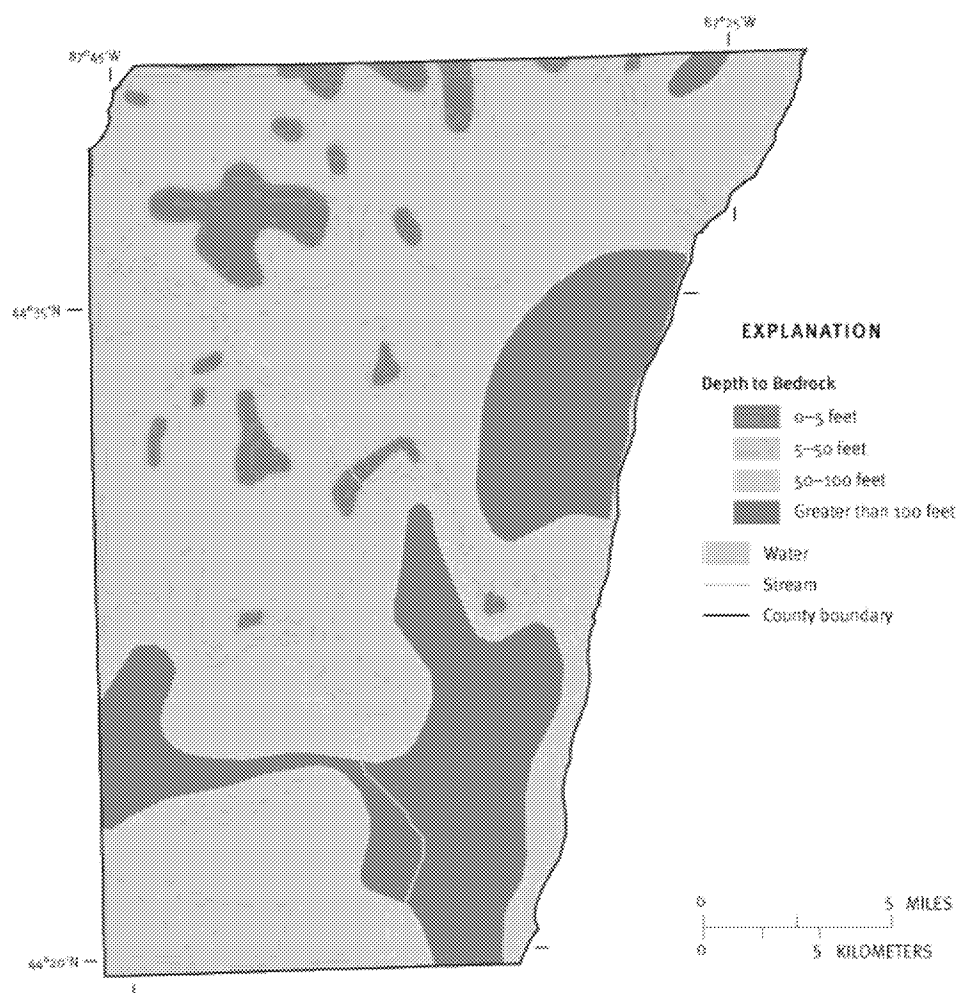
Intertwined in this agriculturally dominated landscape is a unique “karst” dolomite bedrock aquifer (see map [page 12](#)). Karst refers to fractured bedrock encompassed with sinkholes, crevices, caves, cracks, fractures and other features that can provide direct conduits from the surface to the groundwater. Within Kewaunee, Door and some other counties, there are areas of shallow soils (less than 60 inches) over fractured bedrock and other areas where fractured bedrock is located at the surface. Pollutants from agricultural fields, animal feeding operations or septic systems can enter groundwater through these conduits and be taken up in water wells, causing the water to be unsafe for drinking and other household uses.

Karst areas are common throughout the eastern and southern parts of Wisconsin, and along the Mississippi River. The susceptibility of this geology to groundwater contamination is dependent on several factors, including soil type and depth. Generally, the shallower soil depths, the greater the risk of groundwater and well contamination.

A majority of Kewaunee County residents rely on groundwater for their drinking water, which is provided by their private wells. Of wells tested, results showed approximately one third have been unsafe due to high nitrates (10ppm or greater) and/or bacteria. The percentage of unsafe wells increases in townships like Lincoln and Red River that have shallow soils over karst bedrock.

Furthermore, many of these residents also rely on private septic systems to treat their household waste, which can be a source of nitrates and pathogens in groundwater. In Kewaunee County, there are approximately 4,785 septic systems.

Kewaunee County – Depth to Bedrock



This resource characteristic map was derived from generalized statewide information at small scales, and cannot be used for any site-specific purposes.

Map Source: Schmidt, R.R., 1987, Groundwater contamination susceptibility map and evaluation: Wisconsin Department of Natural Resources, Wisconsin's Groundwater Management Plan Report 5, PUBL-WR-177-87, 27 p.

Local Action

In 2014, Kewaunee County initiated the Public Health & Groundwater Protection Ordinance to promote the public health, safety and general welfare of the citizens of Kewaunee County through proper land use and management on geographically vulnerable areas.

In the April 2015 general election, Kewaunee County citizens voted on and passed this Ordinance by an overwhelming 83 percent.

The Public Health and Groundwater Protection Ordinance states:

1. Wastes "SHALL NOT" be mechanically applied to land, or allowed to drain to, landscapes likely having 20 feet or less to carbonate bedrock during January 1st – April 15
2. Wastes "SHALL NOT" be mechanically applied to landscapes likely having 20 feet or less to carbonate bedrock when Soil is Frozen, Snow Covered or Saturated; when Snow is actively melting or precipitations capable of producing runoff w/in 24 hours
3. Wastes "SHALL NOT" be mechanically applied to direct conduits to groundwater, or allowed to directly drain to direct conduits to groundwater; and
4. Temporarily stockpiling/stacking of wastes on landscapes 20' or less in soil shall not occur during January 1st – April 15th.

UNLESS an exemption is issued in writing by the Land Conservation Committee.

Chapter 1 – Short-term Solutions Workgroup Recommendations

During the course of the workgroup’s meetings, many recommendations and strategies for addressing the issues faced by individuals with contaminated wells were discussed. Some of these recommendations have already begun to be put into place, while many will need to be considered by one or more of the stakeholder groups listed in the scope document.

Below is listed a compilation of the workgroup’s final recommendations. The recommendations are grouped by particular stakeholder or stakeholders that may be involved in implementation (e.g. Wisconsin Department of Natural Resources, Kewaunee County, local citizen/farmer groups, etc.).

Also, recommendations perceived to have high potential for improving/protecting groundwater quality are ranked first. Other ideas or proposals that were not forwarded by the workgroup are listed in [Appendix B](#).

Finally, the bracketed and bold items at the end of each recommendation list the “theme” or area where the recommendation should be addressed (e.g. regulatory, communication, etc.).

WI Department of Natural Resources

1. DNR consider beginning an investigation on all E.coli positive samples reported to them from well owners in Kewaunee County. If offsite livestock contamination seems plausible investigation will include Microbial Source Tracking (MST) sampling at no cost to the well owner. (In progress) **[Specific Short Term Solutions]**
2. Prioritize investigating the possibility of streamlining the creation of Special Areas of Eligibility for Well Compensation in Kewaunee County based on the potential for groundwater contamination by livestock due to vulnerable geologies and common land use practices. Kewaunee county residents have requested the entire county or large portions of the county be designated as an Area of Special Eligibility for Well Compensation. **[Regulatory]**
3. Use its authority under Chapter NR738 of Wisconsin Administrative code to provide emergency water supplies to well owners whose wells are impacted by offsite livestock bacterial or nitrate contamination that are located within an area of Special Eligibility for Well Compensation. **[Regulatory]**
 - If DNR does not allow for nitrate contamination to trigger compensation in Areas of Special Eligibility for Well Compensation, then it should consider modifying the definition of hazardous substance in NR738 to include nitrate contamination from livestock.
4. If E. coli contamination is detected and evidence suggests livestock contamination or a contamination event occurs, letters are sent to nearby households that are determined to be potentially impacted. **[Communication]**

5. Develop clear guidance at the county and DNR level regarding respective processes for responding to a contamination event. (In progress) **[Communication]**
6. Consider increase funding for follow-up sampling and investigation in relation to E coli positive samples in which offsite livestock contamination is the probable cause. **[Funding]**
7. Develop a communication plan for distributing to the public the recommendations discussed and findings of the Short Term Solutions workgroup. This may include consideration of coordinating and holding a public meeting or series of meetings and participation by all workgroup members. (In progress) **[Communication]**
8. DNR create a brochure / fact sheet detailing bacteria contamination with information on potential sources, contamination definition, remediation, and funding assistance. This document should be shared with all stakeholders including laboratories in Wisconsin certified for bacteria analysis. (In progress) **[Communication]**

State of WI Legislature

1. Consider taking action to make revisions to Wisconsin State Statute 281 which includes the provision for the Well Compensation program. **[Regulatory]**
Specific revisions to include:
 - Raising or removing income limitations
 - Clarify potential payment procedures
 - Raise or eliminate any total payment limitations.
 - Alter specific sampling requirements to foster a more efficient process for well owners that may be in a pre-determined Area of Special Well Compensation Eligibility.
 - Include other agricultural contaminants as eligible indicators of livestock contamination. (i.e. nitrate, viruses, and other detectable pathogens)
 - Add specific language that allows for the creation of large Areas of Special Well Eligibility for Well Compensation tied to vulnerability geology and livestock contamination.
2. Consider increasing funding to the state Well Compensation program if changes in policy or statute cause a funding deficit. **[Funding]**
3. State legislators appropriate for \$300,000 in, onetime, special funds to provide reparations, including, providing emergency safe water supplies, treatment systems, and new well construction, to households with wells impacted by offsite livestock contamination. **[Funding]**

Kewaunee County

1. Develop clear guidance at the county and DNR level regarding respective processes for responding to a contamination event. (In progress) **[Communication]**
2. Develop a protocol to immediately provide an emergency supply of drinking water for owners of wells impacted by offsite contamination until another source of safe drinking water can be provided or a long term solution is in place. **[Specific Short Term Solutions]**

3. Consider annually making \$10,000 and staff available to provide emergency water supplies free of charge to those households with wells impacted by offsite livestock contamination. **[Funding]**
4. County actively seek and obtain grants and other programs whose funds would be appropriated to paying for a semi-annual well testing program, emergency water supplies, and potential remediation of contaminated wells. **[Funding]**
5. The Kewaunee County Health Department work with DNR to create and distribute a letter to all county well owners detailing the importance of private well sampling. This letter should include information about obtaining sample kits, contaminants to sample for, follow up to results, and specific contact information for DNR and Kewaunee Co. (In progress) **[Communication]**
6. Provide informational materials to county well owners that include easy to use contact information lists (i.e. refrigerator magnets) and up to date well safety and maintenance checklists. **[Communication]**

Local Groups / Citizens

1. Agricultural producers consider making emergency water supplies available for owners of wells impacted by livestock contamination. **[Specific Short Term Solutions]**
2. Area farmers or other local citizen groups consider forming a group to create a fund to provide emergency water supplies free of charge to those households with wells impacted by offsite contamination. **[Funding]**
3. Community groups are working with local municipal drinking water systems to set up a method for owners of wells impacted by livestock contamination to attain a safe emergency water supply from them as a temporary solution until other recommendations are implemented. (In progress) **[Specific Short Term Solutions]**
4. Local Non-Profit groups consider contacting United States of Agricultural (USDA) in regards to the USDA "Household Water Well System" Grants. **[Funding]**

Chapter 2 – Compliance Workgroup Recommendations

During the course of the workgroup's meetings, the members reviewed and evaluated the compliance structures regarding currently regulated activities that may affect groundwater. This included activities regarding well installation/compliance, septic system compliance, municipal and industrial land application, septage waste land application and farm generated manure and process wastewater land application.

Some of these recommendations have already begun to be put into place, while many will need to be considered by one or more of the stakeholder groups listed in the scope document.

Below is listed a compilation of the workgroup's final recommendations. Those recommendations perceived to have high potential for improving/protecting groundwater quality are ranked first.

There were 14 recommendations that reached consensus/near consensus (11 total) or had 2/3 majority in agreement (3 total). Additional recommendations (19 total) either did not have 2/3 majority of members in agreement or the workgroup decided not to carry the recommendation forward. Other ideas or proposals that were not forwarded by the workgroup are listed in [Appendix C](#).

Finally, the lead stakeholders that may be implementing the recommendations are listed in bold at the end of each recommendation.

1. Conduct more land application hauling audits/oversight in sensitive areas. **[DNR and County]**
2. Staffing - Add compliance staff position(s) to conduct improved compliance oversight (examples listed below) of existing regulations regarding agriculture in sensitive areas **[DNR]**. Fill vacancies in a timelier manner. Additional **EPA, DATCP, County, NRCS** staff may also be relevant to fulfilling some of the duties below.
 - Voluntary training and outreach/education for farmers, citizens, haulers, crop consultants, landowners, etc.
 - Review new maps, rules and regulations, and best management practices
 - Summarize and discuss land application audit findings
 - Spill prevention and response planning
 - Joint-agency training (EPA, DNR, NRCS, DATCP, County) for consistency and efficiency
 - Review nutrient management plans (CAFO)
 - A minimum of 10 detailed reviews/audits per year
 - Confirm all land is under agreement
 - Ensure all direct conduits to groundwater are mapped
 - Confirm there are no overlapped fields in multiple CAFO NMPs
 - More frequent inspections of land application sites
 - Target before, during, after rains, first snows and night time spreading
 - Include medium farms

- Use well testing research information to determine which areas to focus
 - Do audits in mapped shallow soils areas
 - Do both scheduled and unannounced inspections
 - More frequent production site inspections of CAFO farms (1/year) by DNR.
 - Verify permit conditions are being met.
 - Verify no changes have occurred since last inspection that are adversely affecting surface or groundwater.
 - More thorough review of permit-required record-keeping regarding CAFO production sites by DNR (annual reports, spill response plans, evaluations, etc.)
 - Inspection of medium sized livestock production sites not yet inspected by County LWCD.
 - This would be to identify potential surface or groundwater discharge issues at the production site.
 - May determine if any medium farms require a CAFO permit.
 - More timely complaint response and enforcement.
3. More stringent review of CAFO emergency land spreading variances. **[DNR]**
- Do they have adequate storage (or need to build more or reduce herd size)
 - Store instead of land apply
 - Only for emergencies, not poor weather conditions
- [Note: Recommendations 2 & 3 were tied in ranking average.]*
4. Require that all land applicators have, at minimum, one set of spreading restriction maps and written instructions present for land application sites where manure is actively being applied. **[DNR & County]**
- Inform haulers and farmers of requirement
 - Discuss any equivalent options in lieu of multiple maps (field markers, tillage, etc.)
5. Targeted focus on proper well abandonment of non-compliant wells or wells no longer used. **[DNR]**
6. Further evaluation and review of existing enforcement processes. **[DNR, County, EPA]**
- Considerations:
- Second offense for same violation should move to Notice of Violation stage not another Notice of Noncompliance letter (DNR).
 - Noncompliance with County regulated state programs (NR151, Farmland Preservation, etc.) results in County enforcement notice and potential loss of tax credits.
7. Fill currently vacant DNR conservation warden position in Kewaunee County. **[DNR]**
8. Continue and improve communications and outreach to farmers/landowners from agencies **(DATCP, NRCS, County LWCD)** regarding:
- Winter (frozen or snow-covered ground) spreading
 - Explain why winter spreading is a concern.
 - Explain best management practices if winter spreading is necessary.

- Provide resources for grant funding or technical assistance.
- General cropland best management practices
 - Explain benefits of no till, cover crops, filter strips, etc.
 - Cost share funding
 - Technical assistance
 - Spreading on sensitive areas
- 9. Develop guidance that defines and explains “substantial compliance” requirement for CAFO permit reissuance. May include: inspection checklist updates; staff training, template reporting resources, and clearer permit conditions. **[DNR, EPA]**

[Note: Recommendations 8 & 9 were tied in ranking average.]

10. Resources/Technology for agricultural compliance staff use and efficiency (internal/non-public) – database of information electronically accessible for multiple compliance agencies. **[EPA, DNR, County]**
 - Nutrient management plan information
 - Pending compliance/complaint response status
11. During land application complaint response, DNR and County shall encourage having all associated parties present (e.g. farmer, hauler, crop consultant, complainant) during complaint inspection. **[DNR, County]**
 - Promote understanding / communication
 - Copy all on follow-up letters and reports
 - Not required as not always practicable

[Note: Recommendations 10 & 11 were tied in ranking average.]

12. Develop communication plan for all landowners who rent land for application of wastes. **[County/Local groups]** The communication plan may include:
 - Information on regulations regarding land application of wastes
 - Example landowner agreements between farmers and landowners
 - Any potential liabilities of landowner
13. Improve review and approval process of offsite waste distribution by non-agricultural waste generators into agricultural waste storages. **[DNR & County LWCD]**
 - Develop guidance/communication plan between DNR wastewater and DNR CAFO programs to ensure any approvals for acceptance meet all standards/conditions.
 - Develop guidance / communication plan between DNR wastewater and County LWCD to ensure storages proposed to accept offsite wastes are built to standards protective of groundwater.
 - Review by County and DNR should include whether nutrient management plans address how additional waste volumes taken will be land applied according to standards.
 - Development of additional resources for tracking compliance (funding dependent).
 - GIS tracking system
 - Template forms

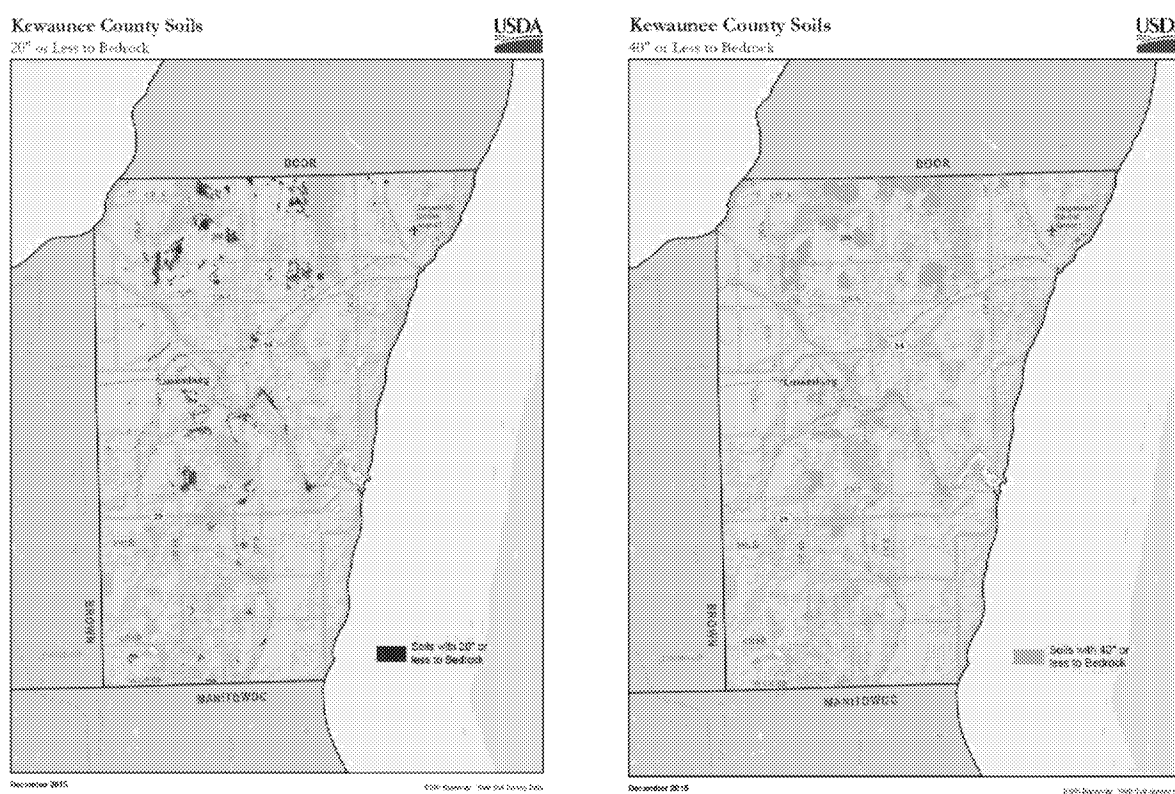
14. Develop communication plan for public regarding compliance and enforcement activities (e.g. agricultural, industrial and septage) being conducted by DNR. **[DNR]**

- Discuss how to report/what to report (factsheets)
- How to share complaint resolution / findings with public
- Online accessible database
 - CAFO permits and application information
 - CAFO nutrient management plans
 - CAFO engineering information
- Stepped enforcement actions
 - Enforcement letters (NON, NOV, etc.)
 - DOJ referral case summaries and outcomes once completed/settled

Chapter 3 – Best Management Practices/Sensitive Areas Workgroup Recommendations

The Defining Sensitive Areas and Management Practices to Reduce Groundwater Contamination Workgroup met nine times between August 2015 and March 2016. The workgroup first discussed and reached consensus on defining sensitive areas during its August and September 2015 meetings and also reviewed and discussed existing documents that identified sensitive areas and management practices for reducing groundwater contamination (see [Appendix D](#) for these documents and context of workgroup discussion and consensus recommendations).

The workgroup then discussed using NRCS soil bedrock maps for Kewaunee County, and their limitations, to identify sensitive areas based upon bedrock depth (see charts below).



During the October 21, 2015, meeting each workgroup member was requested to submit a maximum of 10 management practice recommendations for sensitive areas that would reduce the risk for groundwater contamination. A total of 46 recommendations and 10 topics that could lead to management practice recommendations were submitted and are included in this report. Not all workgroup members submitted management practice recommendations, and some recommendations submitted did not describe a specific management practice.

From November 2015 through March 2016, the workgroup worked to reach consensus on the submitted recommendations with management practices. However, due to detailed and robust workgroup discussion and time/schedule limitations from various workgroup members, not all submitted recommendations or topics received discussion or consensus agreement from the workgroup.

The consensus recommendations are listed below. All proposed recommendations or ideas submitted by the workgroup are listed in Appendix D, [page 37](#), and are grouped into the following categories: Incorporated into Consensus Recommendations; Discussed but no consensus; Not discussed. The proposed recommendations in Appendix D have not been altered and are listed with the wording used by the specific workgroup member(s); nor are they ranked in priority.

During its February and March 2016 meetings, the workgroup also agreed on the following:

- The consensus recommendations reflect interim or intermediate steps that farmers can implement on a voluntary basis to reduce the risk for groundwater contamination. The consensus recommendations are not final and should be evaluated over time, for implementation and effectiveness.
- Some consensus recommendations focus on pathogen reduction and are not directed toward reducing nitrate leaching to groundwater.
- None of the consensus recommendations are meant to override meeting current performance standards (e.g., NR 151 and NR 243) or technical standards (e.g., NRCS 590) related to nutrient management or soil conservation.
- Reconvening the workgroup in fall or winter 2016 to review the workgroup's consensus and proposed recommendations is appropriate.

Consensus Recommendations

Recommendations are ranked in priority order with greatest potential for improving/protecting groundwater quality.

1. No mechanical applications of manure on soils with a soil depth less than 12 inches to bedrock.

The next three recommendations received the same ranking score from the workgroup; therefore all have the same priority 2 ranking.

2. Inspect fields according to a., b., and c. below for depth to bedrock, groundwater conduits, contributing channels or areas that drain to groundwater conduits, drain tiles that may drain/discharge to groundwater conduits and evidence of fracture traces; keep inspection logs and update NMP maps with identified features.
 - a. Inspect annual cropped fields in spring before manure application, tillage, or planting or in late summer/fall after crop harvest and before manure application, tillage, or planting.

June 2016

- b. Inspect alfalfa and perennial cropped fields in spring and summer before or 7-10 days after cutting – look for uneven crop growth that follows distinct lines.
 - c. Use direct measurements (backhoe, probe, test pits, etc.) to verify depth to bedrock and groundwater.
2. On soils with less than 24" to bedrock, no manure applications of liquid manure are allowed. Liquid manure is defined as having less than 12% solids content.
 2. Depth to Bedrock Recommendations – open .pdf file below
Incorporates recommendation 1 and 2 above.

[NOTE: Please see Appendix D, [page 37](#), for the chart for Bedrock Depth Recommendations.]

3. Direct Conduits to Groundwater Recommendations – open .pdf file below
Incorporates recommendation 1 above.

[NOTE: Please see Appendix D, [page 37](#), for the chart on Direct Conduit To Groundwater Recommendations.]

4. All nutrient sources and not just manure should be considered.
5. All livestock operations that apply manure prepare and implement a NM plan that reflects, at a minimum, the proposed 2015 NRCS 590 standard.
6. Analyze low solids content manure for ammonia and adjust the first year available nitrogen based on the results, per UW A2809, Nutrient Application Guidelines, Chapter 9, page 73, Table 9.1.
<http://corn.agronomy.wisc.edu/Management/pdfs/A2809.pdf>
7. Depressional groundwater recharge areas over shallow bedrock needs a clear definition; specifically the workgroup needs to define the term 'shallow.'
8. Practices need to reflect manure type and not farm size. Manure characteristics (e.g., solids, nutrient and pathogen content) help better define groundwater contamination risk(s) and should be a primary criterion for practice recommendations.
9. On soils with less than 12" to bedrock, livestock may be pastured as long as the following items are met:
 - a. Pasture is maintained in adequate, perennial vegetation;
 - b. Vegetation is maintained year round;
 - c. Producer develops and maintains a grazing plan; and
 - d. The grazing plan, at a minimum, meets both NRCS Standard 590, Nutrient Management and 528, Prescribed Grazing.
<https://efotg.sc.egov.usda.gov/references/public/WI/528.pdf>
10. The workgroup needs to focus on winter spreading plan requirements to address manure applications on soils > 20 feet to rock during winter – frozen or snow covered soils

11. For manure mixed with industrial waste, require chloride sampling and other applicable WPDES permit sampling requirements, as authorized under NR 214.17, Wis. Adm. Code, in addition to N, P, K.

http://docs.legis.wisconsin.gov/code/admin_code/nr/200/214.pdf

Chapter 4 – Communication Workgroup Recommendations

The main purpose of the Communications Workgroup was to provide a plan and strategy to help with outreach and dissemination of the recommendations in the final report. With the completion of this report, the workgroup's effort is complete.

However, during the various workgroup meetings, members agreed there were communication issues that could be addressed via additional recommendations.

Below is the communication plan for the final report along with a list of those additional recommendations. The lead stakeholders that may be implementing the recommendations are listed in bold at the end of each recommendation.

Final Report Communications

Goals

- Get the word out. To communicate/reach out to key stakeholders, audiences, etc. about the proposed recommendations of the workgroup.
- Increase Awareness. To increase public's awareness and understanding of the workgroup and the proposed recommendations as they affect the various stakeholders through potential legislative, administrative and/or voluntary changes (DNR, local governments, DATCP, etc.).
- Improve Information Access. Provide the public and media better access to information about the workgroup's process and the final report/proposed recommendations

Objectives

- Develop communication plan.
- Develop process to complete final report.
- Release final report and possible news release, post web content, etc.
- Reach out to key stakeholders with final report via key communication tools.
- Follow up, evaluate implementation.

Audiences

- Local citizen organizations, general public
- County boards/local governments
- Local gov't. associations – WI Counties Ass. WI Towns Ass. (+ local chapters), WI League of Muni's
- Environmental groups – MEA, Clean Water WI, Clean Water Acton Council, etc.
- UW-Extension ag. agents
- WI Ass. of professional ag consultants (WAPAC) (statewide mtg. March 10-11)
- Manure haulers (statewide mtg. January 26-27 WI Dells)
- Certified Crop Advisors
- PDPW
- Groundwater task force

- Well drillers/pump installers
- EPA
- Certified bacteria laboratories within WI (50)
- County and state health departments (WALDAB)
- State agencies, legislators, etc.

Communication Tools

- Media – news release/newspapers
- Ag Media – Ag Radio, UW-Extension newsletter, etc.
- Organizational web sites
- Direct contact
 - Letters to key stakeholders
 - In-person meetings, presentations (see chart above)
 - Emails
- DNR GovDelivery (i.e. e-newsletter)
- Social media
- County extension Facebook page?
- WI Land & Water database

Time Line

- February-March: Conclude meetings, review/approve recommendations
- March-April: Develop final report
- April-May: Review/approve final report
- June: Release final report to target audiences via comm. tools (see above)

Other Communication Recommendations (From other workgroups)

State Agencies

- DNR create a brochure/fact sheet detailing bacteria contamination with information on potential sources, contamination definition, remediation, and funding assistance. This document should be shared with all stakeholders including laboratories in Wisconsin certified for bacteria analysis. **[DNR]**
- If E. coli contamination is detected and evidence suggests livestock contamination or a contamination event occurs, send letters are sent to nearby households that are determined to be potentially impacted. **[DNR, DHS, DATCP]**
- Develop communication plan for public regarding compliance and enforcement activities being conducted by DNR (agricultural, industrial and septage). **[DNR]**
 - Discuss how to report/what to report (factsheets)
 - How to share complaint resolution / findings with public
 - Online accessible database
 - CAFO permits and application information
 - CAFO nutrient management plans
 - CAFO engineering information

- Stepped enforcement actions
 - Enforcement letters (NON, NOV, etc.)
 - DOJ referral case summaries and outcomes once completed/settled

Kewaunee County

- The Kewaunee County Health Department work with DNR to create and distribute a letter to all county well owners detailing the importance of private well sampling. This letter should include information about obtaining sample kits, contaminants to sample for, follow up to results, and specific contact information for DNR and Kewaunee Co. (In progress)

[Kewaunee County]

- Provide informational materials to county well owners that include easy to use contact information lists (i.e. refrigerator magnets) and up to date well safety and maintenance checklists. **[Kewaunee County]**
- Develop clear guidance at the county and DNR level regarding respective processes for responding to a contamination event. **[Kewaunee County]**

Multiple Stakeholders

- Develop a communication plan for distributing to the public the recommendations discussed and findings of the Short Term Solutions workgroup. This may include consideration of coordinating and holding a public meeting or series of meetings and participation by all workgroup members. **[DNR, County, Local Groups]**
- Inform haulers and farmers of requirement that all land applicators have, at minimum, one set of spreading restriction maps and written instructions present for land application sites where manure is actively being applied. **[DNR, County]**
- Develop clear guidance at the county and DNR level regarding respective processes for responding to a contamination event. **[DNR, County]**
- Continue and improve communications and outreach to farmers/landowners from agencies **(DATCP, NRCS, County LWCD)** regarding:
 - Winter (frozen or snow-covered ground) spreading
 - Explain why winter spreading is a concern.
 - Explain best management practices if winter spreading is necessary.
 - Provide resources for grant funding or technical assistance.
 - General cropland best management practices
 - Explain benefits of no till, cover crops, filter strips, etc.
 - Cost share funding
- During land application complaint response, DNR and County shall encourage having all associated parties present during complaint inspection (farmer, hauler, crop consultant, complainant) to promote understanding and communication. **[DNR, County]**
 - Copy all on follow-up letters and reports
 - Not required as not always practicable

- Develop communication plan for all landowners who rent land for application of wastes.
[County/Local groups] The communication plan may include:
 - Information on regulations regarding land application of wastes
 - Example landowner agreements between farmers and landowners
 - Any potential liabilities of landowner
- Develop guidance and communication plans between DNR programs (wastewater and ag runoff) as well as between DNR, County and LWCD to improve review and approval process of offsite waste distribution by non-agricultural waste generators into agricultural waste storages. This will help ensure that any approvals for acceptance meet all standards/conditions and ensure storages proposed to accept offsite wastes are built to standards protective of groundwater. **[DNR & County LWCD]**

Appendix A – Workgroup Structure

Composition

The workgroups consisted of invited participants representing a cross-section of interests concerned with the groundwater quality issues observed in Kewaunee County and around the state. The workgroups did not have any formal authority.

Ground Rules

1. Contribute to an environment of civility.
2. Focus is on learning and problem solving.
3. Remain open to new concepts/information/perspectives different from your own.
4. Everyone will participate and take ownership of group projects and, when appropriate, sub-groups will be assigned to work on specific activities.
5. Focus on underlying interests rather than positions.
6. Make statements, then invite questions and comments.
7. Share all relevant information.
8. Test assumptions and inferences.
9. Everyone has a chance to speak without interruption.
10. No one should dominate the conversation or topic.
11. Disagree openly with any member of the group.
12. Agree on what important words mean.
13. Jointly design ways to test disagreements and solutions.
14. Discuss difficult issues.
15. Keep the discussion focused.
16. Do not throw cheap shots or otherwise distract the group.
17. Make decisions by consensus; where consensus is not possible, document majority and minority perspectives.
18. Exchange relevant information with other stakeholders.
19. The workgroup owns all ideas and concepts; do not talk disrespectfully about team activities in public.
20. Recognize regional/geographic differences and avoid singling out individual entities.
21. At their own discretion, decide whether or not to respond to comments and questions from the audience.

Guidelines for non-member participation

- Comments are always welcome to be submitted to the workgroup chairs.
- Written comments may be submitted at all meetings.
- As time permits, audience members will have opportunities to share comments and concerns with the workgroup, consistent with the ground rules listed above.

Method For Prioritization

Survey Monkey was used by each workgroup to rank recommendations, using a 0-5 point rating scale.

Appendix B – Short-term Solutions Workgroup

Purpose

To review and define issues faced by individuals in Kewaunee County who have wells which are contaminated by bacteria and/or nitrate.

The scope of the workgroup activities will address concerns from these and other concerned citizens and seek to find avenues to provide a safe drinking water source, and/or clear information for those with contaminated drinking water to quickly and efficiently obtain a safe drinking water source.

Expected Outputs/Products

The workgroup will compile and review existing statutes, administrative rules, and policies, creating clear and understandable guidance detailing the current tools available through the state and county.

The workgroup will also outline the limitations of potential sources of aid available through the state or county. The members of this group will then work together to create a list of recommendations or suggestions to address these outlined limitations. The workgroup will seek consensus on all recommendations. Where consensus is not possible, the final guidance will include majority and minority perspectives.

The recommendations are intended for: impacted citizens, DNR, and other interested stakeholders, including, but not limited to, local government officials.

Workgroup Members

- Kyle Burton - DNR Drinking Water and Groundwater (chair)
- Russ Rasmussen - DNR Policy Advisor
- Marty Nessman - DNR Drinking Water and Groundwater
- Jodi Parins - Kewaunee County
- John Pagel - Kewaunee County, Pagels Ponderosa
- Davina Bonness - Kewaunee County Conservationist
- Cindy Kinnard - Kewaunee County Health Department
- Dick Swanson - Kewaunee County
- Sara Williams - Midwest Environmental Advocates
- Lynn Utesch - Kewaunee CARES
- Tom Davenport (or representative) - US EPA
- Andy Wallander - Kewaunee County
- Ron Heuer - Kewaunee County
- Dale Konkol - Door County

Other Recommendations

Throughout the course of the workgroup meetings many topics were discussed that stretched outside the formal scope of the groups focus. Many of these topics involved some kind of

contamination prevention methods in reference to manure storage and spreading, which will be specifically covered by the Sensitive Area and Best Management Practices group.

Other recommendations outside the scope of this workgroup revolved around providing funds for county well owners to regularly sample their wells, and educating the public about low cost sampling tools that may help them determine if their wells are being impacted.

It was the opinion of the majority of the participating members that the work of this workgroup be continued and expanded into a “Long Term Solutions in Relation to Groundwater Contamination in Kewaunee County” workgroup.

Appendix C – Compliance Workgroup

Purpose

To review and evaluate the current compliance structure regarding currently regulated activities that may affect groundwater. This includes activities regarding well installation/compliance, septic system compliance, municipal and industrial land application, septage waste land application and farm generated manure and process wastewater land application.

The scope of this workgroup is to provide information for stakeholders to better understand the regulatory structure and ability of regulatory entities to monitor compliance as well as discuss potential tools and outreach methods to promote compliance.

Expected Outputs/Products

The workgroup will compile and review existing information, review existing strategies, and produce written guidance and recommendations for how to promote compliance. The workgroup will determine the format of the final product, which could potentially include narrative summaries along with tables or matrices identifying compliance activities and enforcement actions. It may also include descriptions of new or improved strategies to oversee compliance on activities that may affect groundwater pollution in sensitive areas.

The workgroup will seek consensus on recommendations. Where consensus is not possible, the final guidance may include majority and minority representatives. The full workgroup will attempt to complete some written guidance and recommendations by January 2016; however, additional time may be needed if necessary.

The recommendations are intended for: DNR, local government officials, agricultural producers and other interested stakeholders located in these sensitive areas, including, but not limited to private residents, business owners, etc. Information provided will promote a better understanding of current compliance procedures followed by each regulatory entity. Recommendations may include outreach methods promoting compliance and other compliance oversight strategies to ensure current regulations are being followed.

Workgroup Members

- Casey Jones - DNR Runoff Management (chair)
- Davina Bonness - Kewaunee County Land Conservation Department (LCD)
- Cheryl Burdett - US EPA
- Kyle Burton - DNR Drinking Water and Groundwater
- Paul Cornette - Kewaunee County Dairy Farmer
- Ryan Debroux - Debroux Custom, Manure Applicator
- Sara Geers - Midwest Environmental Advocates (MEA)
- Nick Guilette - AgSource, Certified Crop Advisors
- Dean Hoegger - President of Clean Water Action Council
- Mark Jenks - Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP)
- Joe Johnson - Natural Resource Conservation Service (NRCS)

- Tressie Kemp - Midwest Environmental Advocates (MEA)
- Dale Konkol - Door County Land Conservation Department
- Mary Ann Lowndes - DNR Runoff Management
- Lee Luft - Kewaunee County Resident, County Supervisor, Land and Water Conservation Committee
- Dean Maraldo - US EPA
- Martin Nessman - DNR Drinking Water and Groundwater Section
- Jodi Parins - Town of Lincoln resident
- Bill Phelps - DNR Groundwater
- Judy Polczynski - DNR Environmental Enforcement
- Russ Rasmussen - DNR Policy Advisor
- Heidi Schmitt-Marquez - DNR Industrial Wastewater
- Glenn Selner - Kewaunee County Zoning Department
- Sara Walling - DATCP

Other Recommendations

These did not receive consensus by the Compliance Workgroup members.

- Septic Systems - Additional funding necessary to:
 - Properly identify systems that may be marginally acceptable by performing onsite soils verification by the county and certified soil tester (would determine any necessary upgrades for protection of groundwater)
 - Expedite inventory of those septic systems not yet verified/reviewed
- Perform audits of soil and/or manure test analysis for farms in sensitive areas (DNR or County).
 - DNR or County staff to observe sampling and obtain split samples from crop consultants to be analyzed for verification
- EPA should review all Kewaunee County CAFO nutrient management plans (one-time); Assist DNR with future NMP reviews as necessary.
- Consideration of cumulative effects of proposed farm expansions that result in increased waste being applied in areas determined to be susceptible for groundwater contamination.
 - Additional requirements in permit and NMP for protection of groundwater
- Revise code NR 243 (CAFO) to be more protective of groundwater (land application).
 - Different regulations for land application of wastes in defined sensitive areas (may include special areas of well compensation eligibility)
 - Require additional reporting by CAFO farms
 - Condensed and updated spreading plan (NMP) be submitted to DNR and County just prior to manure spreading.
 - More frequent “near-time” reporting of land application activities
 - Groundwater monitoring at land application sites
 - Clarify or increase emergency winter spreading approval requirements

- Clarify that multiple CAFOs cannot have the same field in their NMPs
- Revise code NR 243 (CAFO) to be more protective of groundwater and surface waters (production site).
 - Require in CAFO WPDES permits compliance monitoring provisions that evaluate conditions in receiving waters on a sampling schedule.
 - Groundwater monitoring at production sites
 - Surface water sampling to wetlands and surface waters.
 - Requirement/clarification that CAFOs shall not accept septage waste in storages. Staff may take samples to verify compliance with this requirement.
- Require CAFOs using permanent manure irrigation systems monitor groundwater at land application sites per NR 214.
- Penalty and forfeitures changes for violations (any regarding waste applications) - Ask legislature to propose increase of penalties /forfeitures for noncompliance. Examples:
 - Discharge to waters of the state monetary forfeiture of \$250,000 with \$100,000 held in escrow for “safe water supply fund” to cover both short and long term solutions; \$50,000 to LWCD to cover costs of local enforcement, cleanup and clean water supplies
 - Spreading/spill violations should have monetary forfeitures after one warning
 - More than one permit violation per year prohibits reissuance of WPDES permit
 - Citation issuance for permit violations
 - Increase minimum / maximum permit violation forfeiture amount in Wis. Stat. § 283.91 to increase the deterrent effect.
- Develop and enforce the penalties for crop consultants when nutrient management plans are incomplete or inaccurate.
- Develop requirements and enforce penalties for manure haulers (third-party) when spreading regulations are not followed and/or land application results in runoff to surface waters or contamination of a private well. May include hauler audits scorecard/ranking system and required certification/training program.
- Require third party inspections of land application. Qualified individual/company would inspect and report on land application activities to DNR.
- Bond posting to allow the DNR to hire contractors to quickly address spills and runoff events. May result in more timely response actions in cases where the responsible party was not responding appropriately.
- To better oversee compliance via inspections of land application sites, require pre-notification of planned land application activities by farms when spreading in areas deemed "extremely vulnerable" in the 2007 NE WI Karst Task Force report (< 5' to carbonate bedrock areas).
 - Email or phone line notification with who, when, where, how much, etc.
 - Accessible by DNR and County LWCD
 - No obligation for fields to be inspected or additionally approved/reviewed (if already in approved NMP)

- Resources/technology for compliance resources for regulated entities – Funds and additional staff (DNR, DATCP, County, Crop Consultants).
 - Create field reference template for nutrient management plan restrictions and setbacks for farmer and custom manure applicator use. This resource may include the follow information:
 - Verification of conduits to groundwater on or near land application sites (existing wells, unabandoned wells, rock pile features, etc.)
 - Restricted spreading areas and setbacks on maps
 - Maximum spreading rates listed on map or other reference
 - Required spreading methods (immediate incorporation, limited rates for surface applications, etc.)
 - Equipment calibration methods
 - Improve land application restriction map legends to include more information on the requirements of the features/colors identified on maps to assist in compliance with limitations on restricted features. Examples:
 - Rate restrictions (Nitrogen restricted, depth to bedrock or groundwater limitations, etc.)
 - Setback areas (Waste prohibition, limited rates, etc.)
 - Incorporation timeline (immediate, 48 hours, etc.)

[Note: Team determined that multiple resources exist and are continuing to be improved (example: Snap Plus 15, Snap Maps); team recognized it is also difficult to have one template being that multiple options may work in an equivalent manner depending on personal preferences of users.]

- Discipline any crop consultants not abiding by code of ethics (CCA board, DATCP).

[Note: Team recognized there is a system in place for this recommendation. DATCP stated that no formal complaints have been brought forth and ultimately it would be up to CCA board to decertify.]

- EPA should be lead authority on CAFO farms in Kewaunee County.

[Note: Recommendation unclear and more of an opinion.]

- Discontinue the DNR practice of addressing exceedances of groundwater quality standards by including alternative concentration limits for production site groundwater monitoring systems in CAFO WPDES permits.

[Note: Recommendation unclear with no practicable alternatives listed in original recommendation.]

- Require crop consultants to attend annual training/update meeting(s) regarding code of ethics and responsibilities for developing and updating NMPs.

[Note: Team recognized that crop consultants are already required to obtain continuing education credits. Team recommended that this may be a communication team topic in which to promote that training sessions for crop consultants have some focus on code of ethics.]

- Increase fees for CAFO permits and nutrient management plans to cover the cost of additional staff/resources. Current fee structure:
 - CAFO permit application (new or reissue) fee \$0
 - CAFO nutrient management plan review fee \$0
 - CAFO engineering plan review fee \$0
 - Annual CAFO permit maintenance fee \$345

[Note: Team determined although additional funding is necessary to better promote compliance and protection of groundwater quality, it was not appropriate to determine where that funding comes from.]

Appendix D – Best Management Practices/Sensitive Areas Workgroup

Purpose

To define sensitive areas that are high risk for groundwater pollution and to recommend management practices that may help reduce or eliminate groundwater pollution and the associated public health risk within these sensitive areas.

Expected Outputs/Products

The workgroup will compile and review existing information and research, and produce written guidance and recommendations that delineate sensitive areas and management practices within sensitive areas that may contribute to groundwater pollution and increased public health risk.

The workgroup final product will include, but not be limited to, narrative summaries along with maps, tables or matrices identifying sensitive areas and recommendations for use (or non-use) of practices intended to reduce or eliminate groundwater pollution in sensitive areas.

The workgroup recommendations are intended for: DNR, local government officials, agricultural producers and other interested stakeholders located in these sensitive areas, including, but not limited to private residents, business owners, etc.

Workgroup Members

- Andrew Craig, Wisconsin DNR Runoff Management Section (chair)
- Russ Rasmussen, Wisconsin DNR Division of Water
- Kyle Burton, Wisconsin DNR Drinking Water and Groundwater
- Bill Phelps, Wisconsin DNR Groundwater Section
- Mary Ann Lowndes, Wisconsin DNR Runoff Management Section
- Brad Holtz, Wisconsin DNR Runoff Management Section
- Joe Baeten, Wisconsin DNR Runoff Management Section
- Don Niles, Agricultural Representative
- Andy Wallander/ Jodi Parins, Kewaunee County Citizen(s)
- Sara Geers, Midwest Environmental Advocates
- Lynn Utesch, Kewaunee Cares Representative
- Davina Bonness, Kewaunee County Conservationist
- Sara Walling/Mark Jenks, Wisconsin DATCP
- Kevin Masarik, UWSP-UWEX – Groundwater
- Kevin Erb, UW-Extension
- Ryan Debroux, Custom Manure Hauler
- Jeff Polenske/Nathan Nyssee, Certified Crop Advisor(s)
- Tom Davenport, EPA
- Betsy Doolittle/Joe Johnson, NRCS Kewaunee County
- Mick Sagrillo, Town of Lincoln Citizen
- Bill Schuster/Dale Konkol, Door County Conservationist/Land Conservation Dept.

Bedrock Depth Recommendations

Bedrock Depth – 0-2 feet

- Avoidance is the best practice to reduce the risk for groundwater contamination on soils 0-2 feet. The mitigation practices that follow reflect interim or intermediate steps that farmers can implement on a voluntary basis to reduce the risk.
- Applying manure on soils with 36 inches or greater depth to bedrock is necessary for adequate pathogen reduction.
- Some mitigation practices below focus on pathogen reduction and may have limited ability to reduce nitrate leaching to groundwater.
- None of the mitigation practices are meant to override meeting current performance standards (e.g., NR 151 and NR 243) or technical standards (e.g., NRCS 590) related to nutrient management or soil conservation.

0-2 feet to bedrock	Practices
	1. 0-1 feet - No mechanical application of manure
	2. 1-2 feet - Avoid mechanical application of manure on these soils and use other available acres, OR, if avoidance not possible, implement all of the following mitigation practices: <ol style="list-style-type: none"> No liquid manure applications No fall manure applications Apply only solid manure in spring Limit solid manure application rate to 15 tons/acre/year Apply within 10 days or less from planting date or apply on a growing crop If possible, treat solid manure to reduce pathogens by composting or other methods
	3. Use NRCS soil units/maps or DNR CAFO maps and field verification to identify location of soil. When possible, use direct measurement (e.g., test pit, probe, etc.) to verify depth to bedrock.
	4. Livestock may be pastured on these soils as long as the following are met: <ol style="list-style-type: none"> Pasture is maintained in adequate, perennial vegetation; Vegetation is maintained year round; Producer develops and implements a grazing plan; and The grazing plan, at a minimum, meets both NRCS Standard 590, Nutrient Management (2015) https://efotg.sc.egov.usda.gov/references/public/WI/590_Standard-(2015-12).pdf and NRCS 528, Prescribed Grazing https://efotg.sc.egov.usda.gov/references/public/WI/528.pdf

Bedrock Depth – 2-3 feet

- Avoidance is the best practice to reduce the risk for groundwater contamination on soils 2-3 feet. The mitigation practices that follow reflect interim or intermediate steps that farmers can implement on a voluntary basis to reduce the risk.
- Applying manure on soils with 36 inches or greater depth to bedrock is necessary for adequate pathogen reduction.
- Some mitigation practices below focus on pathogen reduction and may have limited ability to reduce nitrate leaching to groundwater.
- None of the mitigation practices below are meant to override meeting current performance standards (e.g., NR 151 and NR 243) or technical standards (e.g., NRCS 590) related to nutrient management or soil conservation.

2-3 feet to bedrock	Practices														
	1. Follow standard practices for > 2-20 feet to bedrock														
	2. Use NRCS soil units/maps, County maps and field verification to identify location of soils with bedrock < 40 inches. When possible, use direct measurement (e.g., test pit, probe, etc.) to verify depth to bedrock.														
	3. Avoid manure application on these soils and apply on other available acres OR if avoidance is not possible, implement all applicable mitigation practices (based on manure type) below:														
	a. Apply solid manure with significant pathogen reduction (composting);														
	b. Apply liquid manure with demonstrated pathogen treatment/reduction to 500,000 CFU/ ml or less AND implement the following: <ul style="list-style-type: none"> • Do not exceed NR 214.17(4)(d), Table 3 application rates; use as low application rate as is safe and practical to avoid hydraulic loading of soil <p style="text-align: center;">Table 3 Maximum Weekly Volume of Liquid Waste to be Applied to Landspreading Sites (gal/ac/wk or in/wk)</p> <table border="1"> <thead> <tr> <th>Soil Texture</th><th>18"–36" Depth to Groundwater or Bedrock</th></tr> </thead> <tbody> <tr> <td>Sand</td><td>6,750 (¹/₄ in.)</td></tr> <tr> <td>Sandy Loam</td><td>13,500 (¹/₂ in.)</td></tr> <tr> <td>Loam</td><td>13,500 (¹/₂ in.)</td></tr> <tr> <td>Silt Loam</td><td>13,500 (¹/₂ in.)</td></tr> <tr> <td>Clay Loam</td><td>13,500 (¹/₂ in.)</td></tr> <tr> <td>Clay</td><td>6,750 (¹/₄ in.)</td></tr> </tbody> </table>	Soil Texture	18"–36" Depth to Groundwater or Bedrock	Sand	6,750 (¹ / ₄ in.)	Sandy Loam	13,500 (¹ / ₂ in.)	Loam	13,500 (¹ / ₂ in.)	Silt Loam	13,500 (¹ / ₂ in.)	Clay Loam	13,500 (¹ / ₂ in.)	Clay	6,750 (¹ / ₄ in.)
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Clay Loam	13,500 (¹ / ₂ in.)														
Clay	6,750 (¹ / ₄ in.)														
	c. Apply liquid or solid manure to growing crop or within 10 days of crop establishment;														
	d. Limit solid manure application rate to 15 tons/acre/year;														
	e. Limit total liquid manure application rate to NR 214.17(4) (d), Table 3 rate or UW A2809 rate, whichever is less														

2-3 feet to bedrock (con't.)	Practices
	f. Split/reduce liquid manure application rate to reduce hydraulic loading of soil; factors to consider include: soil moisture and type (how much liquid can the field safely absorb) weather forecast, manure type and solids content and planned/planted cover crop stage;
	g. If liquid manure has < 2.0% dry matter (field average), reduce application rate by 50% and complete split applications;
	h. Use nitrification inhibitors and/or cover crops if they can be successfully established after application;
	i. Do not inject or incorporate manure below 4 inches depth
	j. For late summer and fall applications of manure and organic byproducts ¹ : <ul style="list-style-type: none"> • Use established/growing perennial crops or cover crops as first priority for application. • When a crop is growing, such as perennial crops, overwintering crops, double crops and cover crops, use rates that will not smother these crops and limit N rates to those specified in UWEX A2809 or to 120 lbs/acre, whichever is less. • For annual crops that will not be planted until the following spring or summer, delay applications until soil temp's are less than 50F or October 1st, whichever occurs first and limit manure N application to UWEX A2809 or to 90lbs/acre, whichever is less.
	k. For applications of liquid manure and/or organic by-products with less than or equal to 4.0% dry matter, limit application rates to criteria j. above and use a nitrification inhibitor or surface apply and do not incorporate for at least 3 days.

¹ Organic byproducts means organic materials that are produced as a byproduct of an industrial or agricultural process which can be land applied as a source of nutrients. Examples include: paunch manure, manure solids, food production wastes, process wastewater, and wastewater treatment plant biosolids and waste water if land applied. This definition does not include hazardous and/or industrial waste or manufactured nutrient sources.

Bedrock Depth - 3-5 feet

- Avoidance is the best practice to reduce the risk for groundwater contamination on soils 3-5 feet. The mitigation practices that follow reflect interim or intermediate steps that farmers can implement on a voluntary basis to reduce the risk.
- Applying manure on soils with 36 inches or greater depth to bedrock is necessary for adequate pathogen reduction.
- Some mitigation practices below focus on pathogen reduction and may have limited ability to reduce nitrate leaching to groundwater.
- None of the mitigation practices below are meant to override meeting current performance standards (e.g., NR 151 and NR 243) or technical standards (e.g., NRCS 590) related to nutrient management or soil conservation.

3-5 feet to bedrock	Practices
	1. Follow standard practices for >2-20 feet to bedrock
	2. Use current NRCS and County bedrock depth maps and field verification to identify soils location. When possible, use direct measurement (e.g., test pit, probe, etc.) to verify depth to bedrock.
	3. Avoid manure application on these soils and apply on other available acres OR if avoidance not possible, implement all of the following mitigation practices:
	a. Limit liquid manure application rate to 13,500 gallons/week* and follow UW A2809 to determine total liquid manure application; use low application rate that is safe and practical and avoid hydraulic loading of soil * = weekly liquid manure application rate helps reduce groundwater pathogen risk but may not reduce nitrate loading/loss risk after application; following UW A2809 rates and methods can help avoid applying nitrogen above crop N need.
	b. For late summer and fall applications of manure and organic byproducts: <ul style="list-style-type: none"> • Use established/growing perennial crops or cover crops as first priority for application. • When a crop is growing, such as perennial crops, overwintering crops, double crops and cover crops, use rates that will not smother these crops and limit N rates to those specified in UWEX A2809 or to 120 lbs/acre, whichever is less. • For annual crops that will not be planted until the following spring or summer delay applications until soil temp's are less than 50F or October 1st, whichever occurs first and limit manure N application to UWEX A2809 or to 90lbs/acre, whichever is less.
	c. For applications of liquid manure and/or organic by-products with less than or equal to 4.0% dry matter, limit application rates to criteria 3(b) above and use a nitrification inhibitor or surface apply and do not incorporate for at least 3 days;

	d. Limit solid manure application to UW A2809 rates and incorporate* ² within 72 hours; * = does not apply to no-tillage practices OR fields with perennial forage and other established crops
	e. Do not inject or incorporate manure below 6 inches depth;
	f. Implement as many applicable mitigation practices for 2-3 feet to bedrock soils [3(a-c) and 3(f-h)] as practicable

Bedrock Depth ~ 5-20 feet

- Applying manure on soils with 36 inches or greater depth to bedrock is necessary for adequate pathogen reduction.
- Some mitigation practices below focus on pathogen reduction and may have limited ability to reduce nitrate leaching to groundwater.
- None of the mitigation practices below are meant to override meeting current performance standards (e.g., NR 151 and NR 243) or technical standards (e.g., NRCS 590) related to nutrient management or soil conservation.

5-20 feet to bedrock	Practices													
	1. Follow standard practices for >2-20 feet to bedrock													
	2. Use current NRCS or County bedrock depth maps and field verification to identify soils location													
	3. Implement the following mitigation practices:													
	a. Limit weekly liquid manure application rate to NR. 214.14(4)(d), Table 3 (below) and follow UW A2809 to determine total liquid manure application; use as low application rate that is safe and practical; avoid hydraulic loading of soil by using split applications													
	<p style="text-align: center;">Table 3 Maximum Weekly Volume of Liquid Waste to be Applied to Landspreading Sites (gal/ac/wk or in/wk)</p> <table> <tr> <th>Soil Texture</th><th>Greater than 36" Depth to Groundwater or Bedrock</th></tr> <tr> <td>Sand</td><td>13,500 (1½ in.)</td></tr> <tr> <td>Sandy Loam</td><td>27,000 (1 in.)</td></tr> <tr> <td>Loam</td><td>27,000 (1 in.)</td></tr> <tr> <td>Silt Loam</td><td>27,000 (1 in.)</td></tr> <tr> <td>Clay Loam</td><td>20,000 (¾ in.)</td></tr> <tr> <td>Clay</td><td>13,500 (1½ in.)</td></tr> </table>	Soil Texture	Greater than 36" Depth to Groundwater or Bedrock	Sand	13,500 (1½ in.)	Sandy Loam	27,000 (1 in.)	Loam	27,000 (1 in.)	Silt Loam	27,000 (1 in.)	Clay Loam	20,000 (¾ in.)	Clay
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Clay Loam	20,000 (¾ in.)													
Clay	13,500 (1½ in.)													

² Incorporate means using mechanical equipment to mix applied manure into the soil as much as practicable/possible.

	b. Limit solid manure application to UW A2809 rates and incorporate* ³ within 72 hours; * = does not apply to no fields following no-tillage practices OR fields with perennial forage and other established crops
	c. Do not inject or incorporate manure below 8 inches depth
	d. As many applicable mitigation practices for 2-3 feet to bedrock soils [3(a-c) and 3(f-h)] as practicable

Bedrock Depth – 2-20 feet

- Avoidance is the best practice to reduce the risk for groundwater contamination on soils 0-5 feet. The mitigation practices that follow reflect interim or intermediate steps that farmers can implement on a voluntary basis to reduce the risk.
- Some mitigation practices below focus on pathogen reduction and may have limited ability to reduce nitrate leaching to groundwater.
- None of the standard practices below are meant to override meeting current performance standards (e.g., NR 151 and NR 243) or technical standards (e.g., NRCS 590) related to nutrient management or soil conservation.

>2-20 feet to bedrock	Standard Practices
	1. Use Kewaunee County, NRCS soils/maps or DNR CAFO maps and field verification to identify location of soils. When possible, use direct measurement (e.g., test pit, probe, etc.) to verify depth to bedrock.
	2. Application of manure or other wastes prohibited:
	a. When rainfall > 1 inch is forecast within 24 hours
	b. When DATCP Manure Management Advisory System is RED within application area
	c. Within closed depressions* in fall after crop harvest unless: (1) manure is injected (following tillage practice #9 below) or immediately incorporated ⁴ AND (2) successful establishment** of fall seeded forage crop within application area(s) * = Closed depressions are topographical basins with no external drainage outlet. They can be located using topographic maps and visual interpretation or using ArcGIS tools that use Light Detection and Ranging (LIDAR) surveys. Consult

³ Incorporate means using mechanical equipment to mix applied manure into the soil as much as practicable/possible.

⁴ Incorporate means using mechanical equipment to mix applied manure into the soil as much as practicable/possible.

	<p>with local county government or DNR to determine if closed depressions meets the definition of direct conduits to groundwater⁵ within NR 151 and NR 243.</p> <p>** = Successful establishment means a fall seeded crop germinates and grows to provide substantial vegetative cover of entire field; bare soil area(s) are avoided or minimized to isolated/small areas.</p>
	<p>d. In spring or summer - within 100 feet of low area(s)*, where water regularly ponds up to seasonal high water mark, located inside of closed depressions</p> <p>* = low areas mean bowl shaped area(s) in field with no natural drainage outlet</p>
	<p>e. In spring or summer - within one mile radius of any area that drains into low areas within closed depressions (up to seasonal high water mark), unless manure is injected or incorporated* within 24 hours or prior to any rainfall event, whichever occurs first.</p> <p>* = does not apply to no fields following no-tillage practices OR fields with perennial forage and other established crops.</p>
	<p>3. No emergency spreading or headland stacking on frozen or snow covered soils*</p> <p>* = already covered by Kewaunee County Ordinance, including exceptions</p>
	<p>4. Before applying manure, evaluate and rank fields with low, medium and high risk based upon criteria i-v., below; low risk fields are first priority for application. Avoid high risk fields or use as a last resort.</p> <p>i. % of restricted area within field from setbacks and slope</p> <p>ii. Number of identified karst features within or immediately adjacent to field</p> <p>iii. % field area with identified fracture traces</p> <p>iv. Number of channel(s) in field that lead to identified groundwater conduits or recharge areas within or adjacent to field</p> <p>v. Evaluate soil type, soil conditions, soil depth to bedrock on fields and weather conditions</p>
	<p>5. Implement practices that build soil organic matter (e.g., crop rotation, cover crops, high residue crops, reduced tillage, rotational grazing)</p>
	<p>6. No surface application* on slopes greater than 6% unless spread material immediately incorporated⁶ or injected; no surface application on slopes greater than 12%; * = does not apply to perennial forage or other established crops</p>
	<p>7. When surface applying manure before planting or after harvest, complete incorporation* within 24 hours or before a rain event, whichever is sooner; * = does not apply to perennial forage and other established crops</p>

⁵ "Direct Conduit to Groundwater" means wells, sinkholes, swallets, fractured bedrock at the surface, mine shafts, non-metallic mines, tile inlets discharging to groundwater, quarries, or **depressional groundwater recharge areas over shallow fractured bedrock**

⁶ Incorporate means using mechanical equipment to mix applied manure into the soil as much as practicable/possible.

	8. Apply nitrogen based fertilizers as close to the time of crop establishment/crop uptake as possible or on established crops to minimize N losses below the crop root zone and to groundwater
	9. Complete tillage* prior to application of liquid manure to a minimum of two inches below depth of manure injection/incorporation * = does not apply to fields following no-tillage practices OR fields with perennial forage and other established crops
	10. Headland application (from equipment turning) shall be incorporated within 6 hours or before applying a different field or before a rain event, whichever occurs first

Direct Conduits to Groundwater Recommendations

- None of the mitigation practices are meant to override meeting current performance standards (e.g., NR 151 and NR 243) or technical standards (e.g., NRCS 590) related to nutrient management or soil conservation.
- “Direct Conduit to Groundwater” means wells, sinkholes, swallets, fractured bedrock at the surface, mine shafts, non-metallic mines, tile inlets discharging to groundwater, quarries, or depressional groundwater recharge areas over shallow fractured bedrock. - *Chapters NR 151.002 (11m) and NR 243.03 (20), Wis. Adm. Code*

Sensitive Area	Practice
Direct Conduit to Groundwater	1. Inspect fields according to Recommendation A (below).
	2. Permanently mark identified direct conduits to groundwater and drain tile inlets within field AND implement the following: <ul style="list-style-type: none"> a. Install a 5 foot vegetated buffer around all identified feature(s); b. The feature(s) and 5 foot buffer should not be tilled, planted or receive nutrients
	3. No manure application within: <ul style="list-style-type: none"> a. 1000 feet of public “community” water supply wells (e.g., municipal water supply wells and other than municipal wells serving mobile home parks, nursing homes, apartment buildings, condominiums, etc.); b. 250 feet of private potable and public “non-community” water supply wells (e.g., bars and restaurants, churches and parks); c. 100 feet of all other “direct conduits to groundwater” and 300 feet when soil is frozen or snow covered; d. 100 feet of defined channels and concentrated flow path(s) that lead to 3a, 3b or 3c
	4. For groundwater monitoring wells, consult with local county government, DNR or well monitoring authority (e.g., USGS, UWGB, UWSP, WGNHS) to determine appropriate setback distance before applying manure.
	5. Annually consult with local municipality for boundaries and requirements of local wellhead protection plans

Recommendation A

Inspect fields according to a., b., and c. below for depth to bedrock, groundwater conduits, contributing channels or areas that drain to groundwater conduits, drain tiles that may drain/discharge to groundwater conduits and evidence of fracture traces; keep inspection logs and update NMP maps with identified features.

- a. Inspect annual cropped fields in spring before manure application, tillage, or planting or in late summer/fall after crop harvest and before manure application, tillage, or planting.
- b. Inspect alfalfa and perennial cropped fields in spring and summer before or 7-10 days after cutting – look for uneven crop growth that follows distinct lines.
- c. Use direct measurements* (e.g., backhoe, probe, test pits, etc.) to verify depth to bedrock and groundwater.

* = electric resistivity is not a direct measurement of bedrock depth, but may be used as a guide to make such measurements

Workgroup Members Who Proposed Recommendations

1. Davenport, Tom - EPA
2. Geers, Sarah & Kamp, Tressie – Midwest Environmental Advocates (MEA)
3. Nysse, Nathan, Polenske, Jeff, Debroux, Ryan; Niles, Don – CCA's, Manure Hauler & Farmer
4. Sagrillo, Mick; Utesch, Lynn; & Wallander, Andy (input from Parins, Jodi; Luft, Lee; & Swanson, Dick) – Kewaunee County Citizens
5. WDNR (Craig, Andrew; Phelps, Bill; Baeten, Joe; Holtz, Brad; Burton, Kyle; Lowndes, Mary Anne; & Rasmussen, Russ)

Proposed Recommendations

*Recommendations proposed by workgroup members are below and **are not ranked** in priority order with greatest potential for improving/protecting groundwater quality. The Proposed Recommendations are grouped into the following categories: Incorporated into Consensus Recommendations, Discussed but no consensus, Not discussed.*

Incorporated into Consensus Recommendations

1. CAFO NMPs should not rely on getting rid of all or most of manure on corn fields in the fall. CAFOs should diversify crop fields and time of planned applications.

(Workgroup Member 2)

Workgroup Discussion: Recommendation discussed and partially incorporated into consensus recommendations.

2. Soil depth to bedrock and groundwater:
 - a. No manure application on soils <3 feet to bedrock and groundwater and implement c. below

- b. No untreated liquid manure application on soils <4 feet to bedrock and groundwater and implement c. below
- c. When applying manure on soils > 3 feet (or > 4 feet for untreated liquid manure) to bedrock or groundwater and as weather and soil conditions allow:
 - i. Complete pre-tillage or immediately incorporate manure (except for established alfalfa or other established crops)
 - ii. No injection unless pre-tillage completed
 - iii. Limit application rate to < 10,000 gal/acre/application

(Workgroup Member 2)

Workgroup Discussion: Recommendation discussed and partially incorporated into consensus recommendations.

- 3. No manure spreading on soils with less than two feet to limiting depth or bedrock. (We are not pushing for the 3 feet depth as identified for other activities like septic because manure application is limited by being tied to agronomic rates).

(Workgroup Member 1)

Workgroup Discussion: Recommendation discussed and partially incorporated into consensus recommendations.

- 4. Soil Depth 1-12":
 - a. 590 solid manure
 - i. No manure applications
 - b. 590 liquid manure
 - i. no manure applications
 - c. 243 solid manure
 - i. No manure applications
 - d. 243 liquid manure
 - i. no manure applications

(Workgroup Member 3)

Workgroup Discussion: Recommendation discussed and incorporated into consensus recommendations.

- 5. Soil depth 12-24":
 - a. 590 solid manure
 - i. Allow solid applications
 - ii. Solid manure surface applied and incorp within 72 hours

- b. 590 liquid manure
 - i. Limited applications with treated manure* sources
 - ii. Treated manure* : surface applications 3-7000 gpa on growing crop with sun exposure
 - iii. Maintain greater well and conduit setbacks
- c. 243 solid manure
 - i. Allow solid applications
 - ii. Solid manure surface applied and incorp within 48 hours. Reduced rates allowed to maintain soil OM%. Rates limited to 15 ton/ac
- d. 243 liquid manure
 - i. Limited applications with treated manure* sources
 - ii. Treated manure*: surface applications 3-7000 gpa on growing crop with sun exposure.
 - iii. Maintain greater well and conduit setbacks

*Treated Manure Examples: UV light treated, Digested manure, wash water, ultra low percentage manure or bacteria reduced manure.

(Workgroup Member 3)

Workgroup Discussion: Recommendation discussed and partially incorporated into consensus recommendations.

- 6. Soil depth 24-60":
 - a. 590 solid manure
 - i. Allow solid applications based on agronomic rates.
 - ii. Incorp within 72 hours
 - b. 590 liquid manure
 - i. Allow liquid applications based on agronomic rates or manure analysis using 2 of the following 5 items:
 - 1. Use N stabilizer.
 - 2. Use pre tillage.
 - 3. Cover crops to manage nitrogen if conditions allow.
 - 4. Reduce rate if soil OM is below 2.0% OM.
 - 5. If less than 2% OM use a split application to apply nutrients.
 - c. 243 solid manure
 - i. Allow solid applications based on agronomic rates.
 - ii. Incorp within 72 hours
 - d. 243 liquid manure
 - iii. Allow liquid applications based on agronomic rates or manure analysis using 2 of the following 5 items:
 - 6. Use N stabilizer.
 - 7. Use pre tillage.

8. Cover crops to manage nitrogen if conditions allow.
9. Reduce rate if soil OM is below 2.0% OM.
10. If less than 2% OM use a split application to apply nutrients.

(Workgroup Member 3)

Workgroup Discussion: Recommendation discussed and partially incorporated into consensus recommendations.

7. Soil depth 60" and greater:
 - a. 590 solid manure
 - i. Allow solid applications based on agronomic rates.
 - ii. Surface or incorp
 - b. 590 liquid manure
 - iii. Allow liquid applications based on agronomic rates or manure analysis
 - c. 243 solid manure
 - iv. Allow solid applications based on agronomic rates
 - v. Surface or incorp
 - d. 243 liquid manure
 - vi. Allow liquid applications based on agronomic rates or manure analysis

(Workgroup Member 3)

Workgroup Discussion: Recommendation discussed and incorporated into consensus recommendations.

8. Adopt Karst Task Force #3, Setbacks and Land Draining to Sinkholes, Closed Depressions, or Bedrock Openings in its entirety. (see [Appendix E](#))

(Workgroup Member 4)

Workgroup Discussion: Recommendation discussed and partially incorporated into consensus recommendations.

9. Permanently mark identified GW conduits (sinkholes, other identified bedrock features) and drain tiles within/adjacent to field AND implement the following:
 - a. Install a 5 foot vegetated buffer around the feature(s).
 - b. The feature(s) and 5 foot buffer should not be tilled, planted, or receive nutrients.

(Workgroup Member 2)

Workgroup Discussion: Recommendation discussed and incorporated into consensus recommendations.

10. No manure application within:

- a. 1,000 feet of public “community” water supply wells
- b. 250 feet of private potable and public “non-community” water supply wells
- c. 100 feet of all other “direct conduits to groundwater”
- d. 100 feet of defined channels and concentrated flow paths that lead to a, b, or c.

(Workgroup Member 2)

Workgroup Discussion: Recommendation discussed and incorporated into consensus recommendations.

11. 100’ well setback.

(Workgroup Member 3)

Workgroup Discussion: Recommendation discussed and incorporated into consensus recommendations.

12. 100’ conduit setback (groundwater & surface water).

(Workgroup Member 3)

Workgroup Discussion: Recommendation discussed and partially incorporated into consensus recommendations.

13. Adopt Karst Report recommendation to reduce spreading rates on sensitive areas:

- a. In “highly sensitive” areas:
 - i. No liquid manure may be applied in areas with less than 5 feet to bedrock;
 - ii. Liquid manure rate limited to 6,000 gal/acre/year (NOTE: Bill Schuester also made this recommendation in comments on the 590 standard revisions);
 - iii. Commercial fertilizer applied at the same rate as alfalfa; and
 - iv. No emergency spreading or headland stacking approvals.

(Workgroup Member 4)

Workgroup Discussion: Recommendation discussed and partially incorporated into consensus recommendations.

14. Accept recommendation of Karst Task Force to reduce spread on ‘sensitive areas’:

- a. In Sensitive areas:

- i. Liquid manure limited to 12,000 gal/acre/year or per NMP, whichever is lower
- ii. Winter prohibition on frozen or snow covered groundwater or between Jan 1 – Apr 15
- iii. No spreading of liquid manure within 24 hours before, during or after rainfall with potential for runoff (using DATCP Advisory system)
- b. In Highly Sensitive areas (all of sensitive areas recommendations above and):
 - iv. No liquid manure in areas of less than 5' depth to bedrock.
 - v. Liquid manure limited to 6,000 gal/acre/year (also recommended by Bill Schuster in 590 comments)
 - vi. Commercial fertilizers applied at same rate as alfalfa
 - vii. No lands within highly sensitive area approved for emergency spreading or headland stacking

(Workgroup Member 4)

Workgroup Discussion: Recommendation discussed and partially incorporated into consensus recommendations.

15. Accept recommendation that all applications of liquid manure in sensitive areas be immediately incorporated at a depth of 8 inches or less on harvested fields.

(Workgroup Member 4)

Workgroup Discussion: Recommendation discussed and partially incorporated into consensus recommendations.

16. No application of any waste in closed depressions after fall harvest of crops.

(Workgroup Member 4)

Workgroup Discussion: Recommendation discussed and incorporated into consensus recommendations.

17. Inspect fields according to a. and b. below for GW conduits, contributing channels or areas that drain to GW conduits, drain tiles that may drain/discharge to groundwater conduits and evidence of fracture traces; keep inspection logs and update NMP maps with identified features.
 - a. Inspect annual cropped fields in spring before manure application/tillage/planting or in late summer/fall after crop harvest and before manure application/tillage/planting
 - b. Inspect alfalfa/perennial cropped fields in spring and summer before or 7-10 days after cutting. – look for uneven crop growth that follows distinct lines.

(Workgroup Member 5)

Workgroup Discussion: Recommendation discussed and incorporated into consensus recommendations.

18. No surface application* on slopes greater than 6% unless spread material immediately incorporated or injected; no surface application on slopes greater than 12%

*=does not apply to perennial forage crop(s)

(Workgroup Member 5)

Workgroup Discussion: Recommendation discussed and incorporated into consensus recommendations.

19. Liquid manure should be applied during the growing season or within 10 days of crop establishment and as split applications (not to exceed 10,000 gallons per acre per event) throughout the season. Liquid manure applications during the fall should be avoided as much as possible.

(Workgroup Member 5)

Workgroup Discussion: Recommendation discussed and partially incorporated into consensus recommendations.

20. No manure application when a rain event of 1 inch or greater is forecast within the next 24 hours.

(Workgroup Member 5)

Workgroup Discussion: Recommendation incorporated into consensus recommendations.

21. We encourage the timing limitations to be more stringent. Farms shouldn't be applying manure to fields if there is >0.25-0.5 inch rainfall within the 24 hrs forecast.

(Workgroup Member 1)

Workgroup Discussion: Recommendation discussed and partially incorporated into consensus recommendations.

22. All manure receives recognized pathogen reduction treatment process prior to land application.

(Workgroup Member 5)

Workgroup Discussion: Recommendation discussed and partially incorporated into consensus recommendations.

23. All livestock operations that land apply manure prepare and implement a NM plan that reflects, at a minimum, the proposed NRCS 590 standard.
(Workgroup Member 5)

Workgroup Discussion: Recommendation discussed and incorporated into consensus recommendations.

24. Develop and implement a plan for emergency* liquid waste applications (as defined in NR 243) on frozen and snow covered soils that are > 20 feet to bedrock depth using proposed NRCS 590 winter spreading criteria and the following requirements:
- a. Notify Land Conservation Department and DNR (CAFO farms only) prior to application
 - b. 200 foot setbacks from identified channels that lead/discharge to GW conduits or GW recharge areas
 - c. Evaluate and rank fields for low, medium and high risk emergency applications based upon criteria i-iv. below; low risk fields are first priority for application.
 - i. % of restricted area within field from setback, slope and bedrock depth restrictions
 - ii. Number of identified karst features within or immediately adjacent to field
 - iii. % field area with identified fracture traces
 - iv. Number of channel(s) in field that lead to identified groundwater conduits or recharge areas within or adjacent to field
- *=recommendation presumes 180 days available storage capacity

(Workgroup Member 5)

Workgroup Discussion: Recommendation discussed and partially incorporated into consensus recommendations.

25. Recommendations for “Areas Susceptible to Groundwater Contamination” document:
- a. Adopt the Karst Report recommendations for defining sensitive areas based on depth to bedrock:
 - i. Under 20 feet – highly sensitive
 - ii. Between 21-50 feet – sensitive
 - b. Categorize the following as “highly sensitive”:
 - iii. Any areas that the DNR designates as an “area of special concern” under the well compensation program;
 - iv. SWQMAs

- c. Sensitive areas may be less susceptible to groundwater contamination if the farmers commit to practices such as pasture raising cows, crop rotation, cover crops, keeping and spreading manure in solid form when possible, etc.

(Workgroup Member 2)

Workgroup Discussion: Recommendation discussed and partially incorporated into consensus recommendations.

26. Accept definition of 'sensitive areas' as defined in Karst Task Report aka 'Water Quality Management Area'. Further define:

- d. Under 20' – 'Highly Sensitive'
- e. 21-50' – 'Sensitive'
- f. Add any areas that have been deemed 'areas of special concern' by DNR
- g. Add lands within 1.5 miles of above in recognition that impact to groundwater moves outside of soil depth boundaries
- h. All SWQMA areas considered 'highly sensitive'

(Workgroup Member 4)

Workgroup Discussion: Recommendation discussed, and partially incorporated into consensus recommendations.

Recommendations Discussed, With No Consensus

27. Establish protocol for 3rd party audits of nutrient content of manure storage and soil.

(Workgroup Member 4)

Workgroup Discussion: Recommendation discussed, but was not incorporated into consensus recommendations.

28. Adopt Karst Task Force #4, Requirements for Persons or Conduct Applications of Animal Wastes in Shallow Carbonate Bedrock (<50') Areas its entirety. (please see additional information in this appendix)

(Workgroup Member 4)

Workgroup Discussion: Recommendation discussed, but not incorporated into consensus recommendations.

29. NMPs should be based on nutrient balance assessments to ensure ground and surface water quality standards won't be violated due to discharges. SnapPlus rates are based on optimum crop yield, not nutrient balance assessments. This should be done on a field-by-field basis before a new field is added to a CAFO NMP, or when WPDES permit is issued/renewed.

(Workgroup Member 2)

Workgroup Discussion: Recommendation discussed, but not incorporated into consensus recommendations.

30. Develop land/AU spreading ratio for Sensitive areas of two acres to one AU (Joel Kitchens recommended a ratio of cows to acreage).

(Workgroup Member 4)

Workgroup Discussion: Recommendation discussed, but not incorporated into consensus recommendations.

31. Require signed, written, land contracts/agreements for rented acreage that cover remaining duration of WPDES permit (e.g. a five year contract for a five year permit or a 3 year contract if permit terminated in 3 years).

(Workgroup Member 4)

Workgroup Discussion: Recommendation discussed, but not incorporated into consensus recommendations.

32. Recommend annual soil testing of all fields. Use test as basis for an agronomic rate that maintains or improves soil's nutrient and biological health.

(Workgroup Member 4)

Workgroup Discussion: Recommendation discussed, but not incorporated into consensus recommendations.

33. Require lateral termination of all subsurface field drain tiles within 100 feet of waters of the state, conduits to groundwater, and concentrated flow channels (NOTE: NRCS recommendation).

(Workgroup Member 2)

Workgroup Discussion: Recommendation discussed, but not incorporated into consensus recommendations.

34. Operators should locate all tile lines in advance of obtaining permission to spread on a proposed field. Aerial technology should help.

(Workgroup Member 2)

Workgroup Discussion: Recommendation discussed, but not incorporated into consensus recommendations.

35. Require lateral termination of subsurface field drain tile at a minimum of 100' to Waters of the State, conduits to groundwater, concentrated channels and the like (NRCS recommendation)

(Workgroup Member 4)

Workgroup Discussion: Recommendation discussed, but not incorporated into consensus recommendations.

36. EPA should provide additional funding for the Borchardt study so that it can produce more robust data on the source of the groundwater pollution.

(Workgroup Member 2)

Workgroup Discussion: Recommendation discussed, but not incorporated into consensus recommendations.

37. Work with NRCS to reprioritize EQUIP monies to elevate practices that protect groundwater and surface waters.

(Workgroup Member 4)

Workgroup Discussion: Recommendation discussed, but not incorporated into consensus recommendations.

38. Bio-physical restrictions apply to all operations regardless of size.

(Workgroup Member 1)

Workgroup Discussion: Recommendation discussed, but not incorporated into consensus recommendations.

Recommendations Not Discussed

39. CAFOs should develop more than 180 days of storage given the difficulty acknowledged with calculating volume needed for 180 days, including fluctuating animal populations, and the difficulty of anticipating the number of days in the spring and fall during which CAFOs can landspread due to unknown weather and crop challenges.

(Workgroup Member 2)

Workgroup Discussion: Recommendation not discussed.

40. Help small animal feeding operations develop appropriate storage through cost sharing instead of making it easier for small AFOs to store manure at large CAFOs.

(Workgroup Member 2)

Workgroup Discussion: Recommendation not discussed.

41. DNR should include all applicable provisions of NR 214.20 and NR 214 in WPDES permits that authorize manure irrigation.

(Workgroup Member 2)

Workgroup Discussion: Recommendation not discussed.

42. Expand vegetative buffers around surface waters, especially on fragile or quick-draining soils.

(Workgroup Member 2)

Workgroup Discussion: Recommendation not discussed.

43. Consider surface waters (aka 'Waters of the State' or navigable waters) the same as concentrated flow channel or direct conduit to groundwater.

(Workgroup Member 4)

Workgroup Discussion: Recommendation not discussed.

44. Increase setback for spreading of all manures to 100' of waters of the state.

(Workgroup Member 4)

Workgroup Discussion: Recommendation not discussed.

45. 25' incorporated/inject, 100' surface setback for perennial waterways.

(Workgroup Member 4)

Workgroup Discussion: Recommendation not discussed.

46. 25' setback for wetlands.

(Workgroup Member 4)

Workgroup Discussion: Recommendation not discussed.

Other Topics

In addition to 10 recommended management practices, each workgroup member could also submit additional topics for discussion that may lead to additional recommended management practices. The other topics are grouped into two categories: Incorporated into Consensus Recommendations, Discussed but no consensus, Not discussed.

Incorporated into Consensus Recommendations

1. Further discuss tradeoffs with recommended practices such as limiting applications on shallow soils, crop rotation, cover crops, etc.

(Workgroup Member 2)

Workgroup Discussion: Topic discussed and incorporated into consensus recommendations.

2. Discuss petitioner comments on areas susceptible to groundwater contamination document. (see attached June 8, 2015, petitioner letter to DNR)
 - a. Will this be formal guidance?
 - b. Are there certain areas to designate as susceptible to groundwater contamination such as those with less than 20 feet depth to bedrock? Including a bright-line where feasible adds clarity and consistency.
 - c. Are current standards sufficient for sandy, well-drained soils?

(Workgroup Member 2)

Workgroup Discussion: Topic discussed and partially incorporated into consensus recommendations.

3. Can we invite someone with information on soil health to present? There are some experts at UW-Madison.

(Workgroup Member 2)

Workgroup Discussion: Topic discussed and partially incorporated into consensus recommendations. A soil health workshop was held in Kewaunee County in November 2015.

4. Consider requiring NMPs for chemical fertilizer applications on ALL fields, not just when a CAFO is using a field.

(Workgroup Member 2)

June 2016

Workgroup Discussion: Topic discussed and partially incorporated into consensus recommendations.

Discussed but no consensus

5. Discuss feasibility of CAFOs installing some of the treatment methods used at wastewater treatment plants identified in Heidi's presentation. Primarily treatment to remove solids and spread separately from liquid waste? Secondary treatment?

(Workgroup Member 2)

Workgroup Discussion: Topic discussed, but not incorporated into consensus recommendations.

6. Looking beyond the next one to two years, we need to develop whole system recommendations now that would include manure handling systems, manure management, crop rotation, etc.

(Workgroup Member 4)

Workgroup Discussion: Topic discussed, but not incorporated into consensus recommendations.

7. Also, for longer term solutions begin work on new BMPs that implement the Karst Taskforce recommendations.

(Workgroup Member 4)

Workgroup Discussion: Topic discussed, but not incorporated into consensus recommendations.

8. We recommend to the Alternative Technologies Group that resources be tasked to 'get the water out' of liquid manure (Karst recommendations page 17: 'reduce water use in manure systems to create more solid manure.').

(Workgroup Member 4)

Workgroup Discussion: Topic discussed, but not incorporated into consensus recommendations.

Not discussed

9. (Discuss how to conform SnapPlus or other tools to account for water quality standards for both N and P, so that applications are not just based on optimum crop yield.

(Workgroup Member 2)

Workgroup Discussion: Topic not discussed.

10. Discuss how to better assess the transport of nutrients to surface water through groundwater, including through tile lines and natural transport pathways.

(Workgroup Member 2)

Workgroup Discussion: Topic not discussed.

Areas Susceptible to Groundwater Contamination

Note: This attachment is available on the Groundwater Collaboration Workgroup website at <http://dnr.wi.gov/topic/Groundwater/CollaborationWorkgroup.html>.



Areas Susceptible
to Groundwat...

Sensitive Areas and Practices Documents

Note: These attachments are available on the Groundwater Collaboration Workgroup website at <http://dnr.wi.gov/topic/Groundwater/CollaborationWorkgroup.html>.



Adobe Acrobat
Document



Bedrock Kewaunee...



DNR-Kewaunee
City Practices - D...



Land Application in
Kewaunee County_h...



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Appendix E – Communications Workgroup

Purpose

To discuss how to take the recommendations/items from the workgroups and determine how best to communicate/reach out to our key stakeholders, audiences, etc., so they receive the information in an understandable and accessible way.

Expected Outputs/Products

The expected product of the Communications Workgroup was a communication plan and strategy to help with outreach and dissemination of the recommendations in this final report. With the completion of this report, the workgroup's effort is complete. In addition, workgroup members agreed to provide recommendations addressing additional communication issues.

Composition

The workgroup consists of invited participants representing a cross-section of interests concerned with the groundwater quality issues observed in and around Kewaunee County. The workgroup does not have any formal authority.

Workgroup Members

- Andrew Savagian – DNR Office of Communication (chair)
- Tom Bauman – DNR Runoff Management
- Davina Bonness – Kewaunee County Conservationist
- Kyle Burton – DNR Runoff Management
- Andrew Craig – DNR Runoff Management
- Tom Davenport (or representative) – US EPA
- Sara Geers – Midwest Environmental Advocates
- Callie Herron – UW Discovery Farms
- Casey Jones – DNR Runoff Management
- MaryAnne Lowndes – DNR Runoff Management
- Jodi Parins – Kewaunee County
- Russ Rasmussen – DNR Policy Advisor
- Tony Realì – Calumet County

Appendix F – Related Studies and Reports

Northeast Wisconsin Karst Task Force

In 2006, county and UW-Extension officials convened the Karst Task Force – a group of concerned scientists, conservation professionals and government officials – to determine where impacts on the karst aquifer begin, evaluate the best methods to reduce the impact of agriculture on groundwater quality, prioritize the implementation of available technologies to prevent future problems and identify the gaps in the knowledge base.

The task force released their report in 2007. In their report, the task force identified report areas with less than 5 feet to carbonate bedrock as having an extreme relative vulnerability to contamination; 5-15 feet as high; greater than 15-50 feet as significant; and greater than 50 as moderate relative vulnerability (Karst Task Report, 2007).

Well Water Quality In Lincoln Township

There have also been a number of research studies conducted in the Karst aquifer. The Kewaunee County Land and Water Conservation Department teamed up with the Center for Watershed Science and Education at UW-Stevens Point to study well water quality in the Lincoln Township of Kewaunee County.

The purpose of the research was to investigate seasonal variability for bacteria and nitrate contamination in well water. The study focused on township residents who rely solely on private wells and groundwater as their primary water supply. Ten wells were selected and tested monthly for bacteria and nitrate contamination for one year to investigate seasonal variability.

Coliform bacteria were detected at least once in six different wells; four wells did not have detections of bacteria in any of the 12 sampling events. Levels of coliform bacteria measured were generally low, with the maximum number reported as 60.2 MPN cfu/100mL.

Wells that were positive for one sample period often came back negative the following sample period, even though no chlorination or corrective measures took place. None of the wells tested positive for *E.coli* bacteria.

The research suggested that groundwater chemistry was most stable during the winter period, while changes in groundwater chemistry seemed to coincide with the snow-melt and spring recharge periods.

Results also suggest that, in this geologic setting, an annual present/absent type of coliform bacteria test is likely insufficient to assess the bacteriological/pathogenic safety of a water system year round. Lincoln Township has funded continued testing of 25 wells were for alkalinity, chloride, and nitrates, which started in January, 2015.

Note: Lincoln Township decided to fund continued testing of this research, and beginning in January 2015 researchers started testing 25 wells were for alkalinity, chloride, and nitrates.

Assessing Groundwater Quality In Kewaunee County

Beginning in November, 2015, the DNR began funding a 20-year study being conducted by the University of Wisconsin-Oshkosh, the U.S. Dept. of Agricultural Research Service, Kewaunee County and other agencies to study groundwater in Kewaunee County.

The proposed project seeks to quantify the extent of groundwater contamination by nitrates, bacteria and other pathogens in the county. Objectives include:

1. Design a randomized, synoptic sampling plan that evaluates groundwater quality throughout Kewaunee County. The randomized sample will be stratified by depth to bedrock. Collect and analyze samples from the randomized sampling frame for nitrate and indicator bacteria.
2. Sample a subset of wells from the randomized and stratified sampling frame on a bi-weekly basis (i.e., once every two weeks) to assess seasonal variation in groundwater quality.
3. Sample a subset of wells once per season (four times per year) for viruses and fecal markers capable of distinguishing septic versus bovine sources of contamination.
4. Install an automated sampling system on one or more wells in order to determine the timing of peak transport for viruses and indicator bacteria.
5. Perform statistical analysis of samples collected from this study and of existing water-quality data from Kewaunee County to assess whether these data can shed light on spatial and temporal patterns of contamination.